SCIENTIFIC AMERICAN

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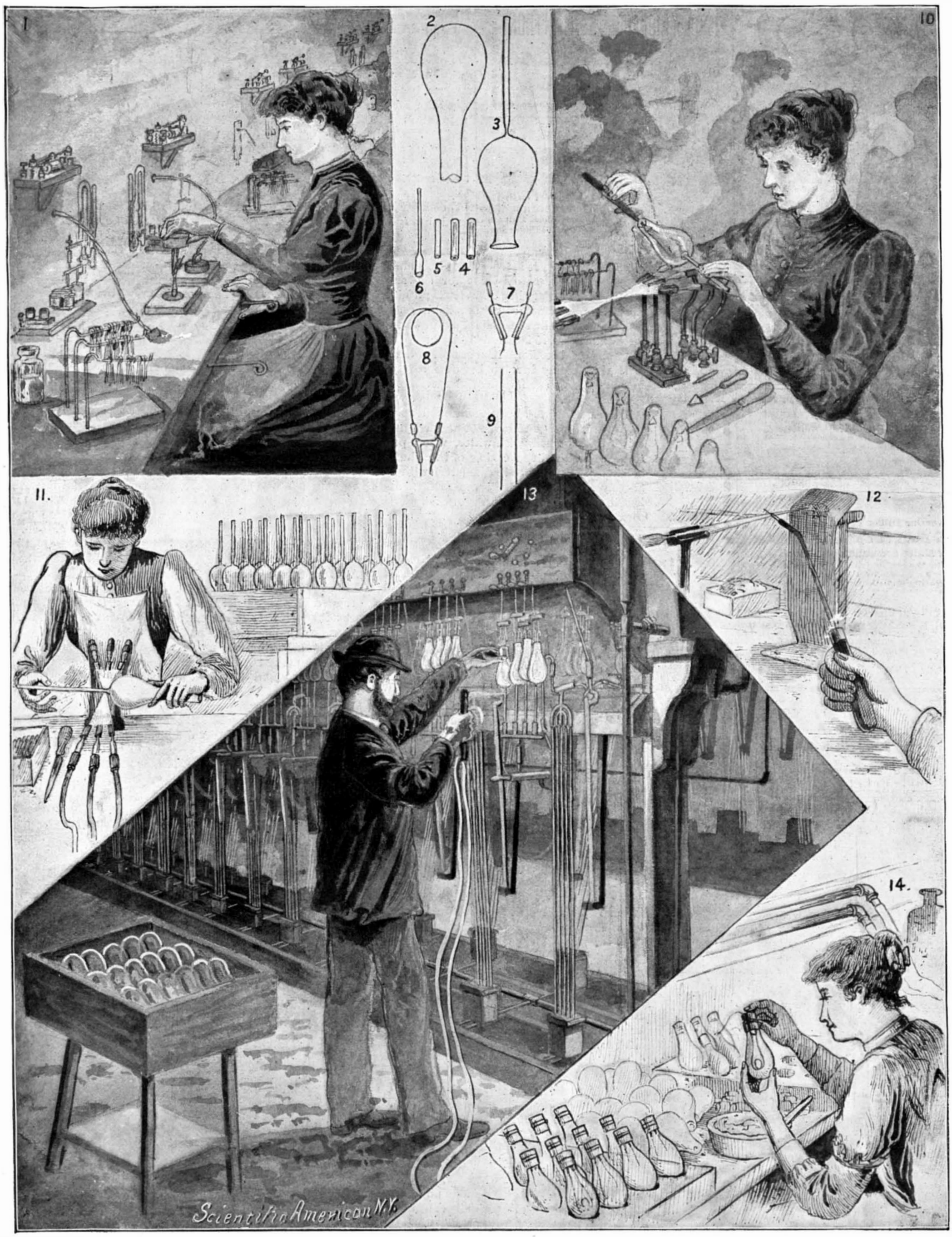

1. Flashing in. 2. Bulb. 3. Tubulated bulb. 4. Insulating tubes. 5. Bridge. 6. Platinum leading-in wires. 7. Mount. 8. Mount and filament complete. 9. Copper connecting wires. 10. Sealing and sinking. 11 Tubulating. 12. Insulating. 13. Exhausting. 14. Capping.

THE MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.—[See page 230.]

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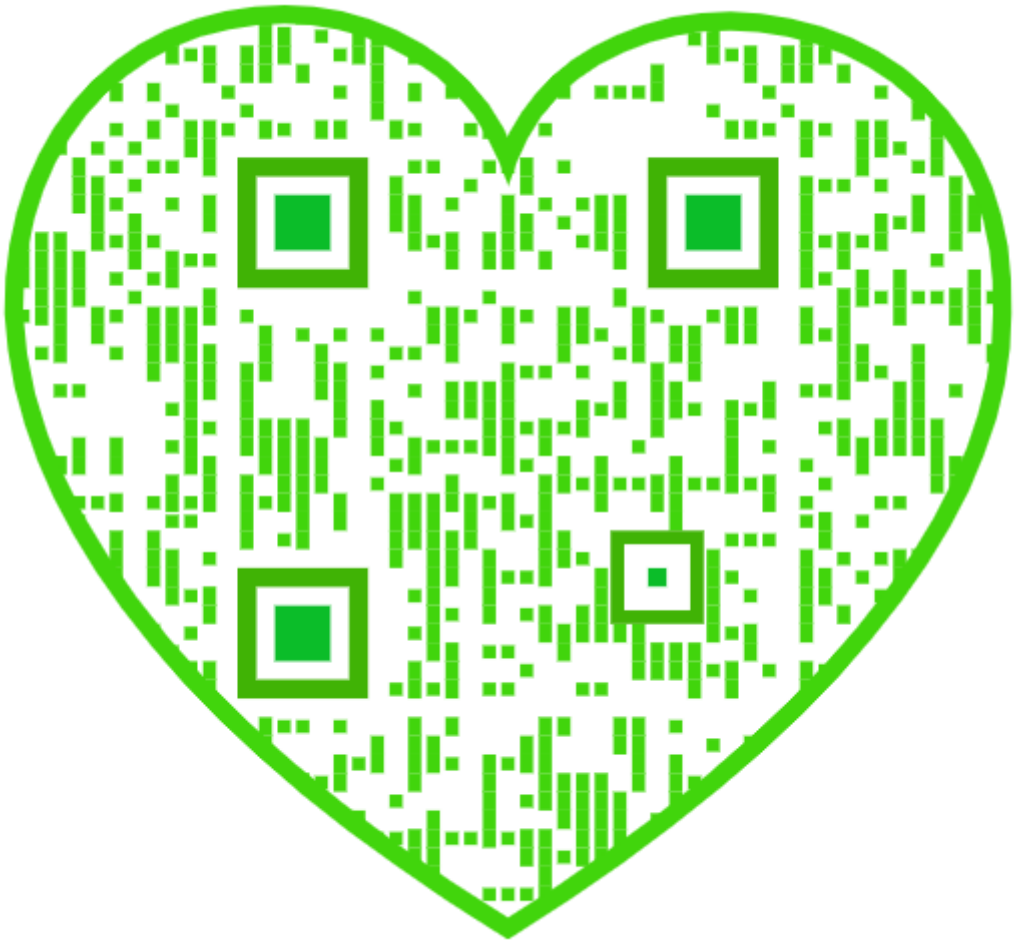

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THE STERN TUNNELS OF THE OLYMPIA.

The following reflections have been suggested by an examination of drawings showing the method adopted for inclosing and supporting the outboard ends of the screw shafts of the United States cruiser Olympia, built at the Union Iron Works, San Francisco, Cal.

In that vessel the outboard ends of the screw shafts for a length of twenty-four feet (the distance between the forward end of the stern bearings and the stuffing boxes through which the shafts emerge from the hull of the ship) are inclosed in tubes three feet nine inches in internal diameter at their forward ends and two feet ten inches where they join the stern bearings. Each of these tubes is made of steel one-half an inch thick, and is connected to the hull throughout its length by a box or cell formed of steel plates three-eighths of an inch thick, stiffened with angle irons. This box has an average depth (measured on a line approximately parallel with the outside of the hull) of three feet ten inches at its forward end and six inches at the forward part of the stern bearing. It will therefore be evident that this cellular connecting box tapers at a much more rapid rate than the tube which it supports. This is done probably to afford the water as free a run to the screws as possible; but this intention is in no small degree defeated by the fact that the bracket arms which support the stern bearing are attached to the hull at points considerably above and below the after thin end of the cellular structure referred to, and have to be dragged through the water, and must, by whatever resistance they oppose, impair the speed of the ship.

These brackets it is true are quite similar to those in common use for many years for the support of the stern bearings of twin-screw shafts; and if there were no better method of accomplishing such support, criticism would have no claim against them; but, as is well known, there is a better way of attaining the end sought, and therefore in a cruiser whose speed at a critical time may involve her own safety and that of her personnel, such improved methods should have been adopted.

The steel tubes above mentioned as inclosing the shafts are, strange to say, not water tight, but, on the contrary, are filled with water, whose presence seems to have required the casing of the shafts (which are of steel sixteen inches in diameter) with a bronze tube (closely fitting it) one inch in thickness and thirty-one feet in length. The weight of each of these bronze casing tubes is about six thousand pounds; furthermore, the water which surrounds each shaft will weigh at least ten thousand pounds, which, added to the weight of the bronze casings of the shafts, makes a weight of sixteen thousand pounds on each side of the stern of this ship, or thirty-two thousand pounds in all, of load which must be sustained and dragged through the water, and consume power for no useful purpose whatever: moreover, in the pitching and rolling of the ship, this useless dead weight subjects the vessel to strains which are totally unnecessary, and which the adoption of modern practice would have avoided.

Just why this faulty construction has been adopted by the Navy Department is not evident. There are rumors that some of the other new vessels are to be built in the same way.

It is well known there are several vessels afloat in which the tubes inclosing the screw shafts are accessible from the interior of the ship throughout their length up to the forward end of the stern bearing, where the stuffing box is placed. This construction makes it unnecessary to incase the shafts with bronze, and allows for their examination at any time. By this construction the extra buoyancy due to the displacement of the shaft tubes is secured, and there is, of course, no strain on the vessel due to a mass of dead weight. This construction is no experiment, but has been used for several years, and so satisfactory has it been found, that the Cramp Ship Building Company have adopted it for the new American liners St. Louis and St. Paul.

In view of what has been done in the matter of shaft tunnels for twin screw vessels, it does seem that the Navy Department had taken a step (if not a tumble) backward, when it inclosed the shafts of the Olympia with tubes filled with water.

Water Consumption in New York and London.

The average daily supply of water to London during January delivered from the Thames was 100,997,567 gallons; from the Lee, 59,835,525 gallons; from springs and wells, 29,046.055 gallons; from ponds at Hampstead and Highgate, 244.452 gallons. The last is used for non-domestic purposes only. The daily total was, therefore, 190,123,599 gallons for a population estimated at 5,481,890, representing a daily consumption per head of 34·68 gallons for all purposes.

The daily consumption of water in New York City is about 183,000,000 gallons, and the population less than one-half that of London. The safe capacity of the new Croton aqueduct is 300.000.000 gallons per diem and of the old aqueduct 75,000,000 gallons.

Influenza: Do Doctors Know Anything About It?

An evening contemporary assures its readers that notwithstanding the fact that we are now in the midst of the fifth successive annual epidemic of influenza, doctors know little or nothing about it.

There is, perhaps, some justification for this in the circumstance that a good many immature practitioners, who desire to pose as scientists in excelsis, have assured the public on many occasions that science really cannot say what influenza is. But now let us ask ourselves with the downrightness of mere common sense what is it that our profession really does know, and know thoroughly, about influenza.

In the first place, we know the disease when we see it; we know also the injurious physiological and pathological changes it produces in the nervous system, the lungs, the liver and other organs of the body; we know how, by prompt, early treatment, to reduce those changes to a minimum; and we know how to repair the damage done by those changes when the disease is brought to a termination.

"But," it will be said, "if you claim to know all these things, you claim to know everything about influenza." No; we do not. We do not claim to know precisely what its cause is; nor do we profess to know entirely how to prevent it. But do we know what the cause of cancer is; or of typhoid fever; or of simple, or even of tubercular meningitis, and a hundred other things? Moreover, in the matter of prevention, can we prevent all other diseases of every kind except influenza? Can the lawyer, who thoroughly understands law, prevent crime? Can the theologian prevent sin? Can even the commercial man put an end to bankruptcy?

Influenza has now been with us for five successive years. We can recognize it, we can treat it rationally and successfully, and to some extent we can prevent it. Perhaps when Providence has endowed us with omniscience and with almightiness as well, we may be able to entirely prevent the disease as well as to cure it. In the meantime a little "silence" might be "golden" on the part of the all-knowing lay journalist.—Hospital.

To Make Woolens Waterproof.

The question of how to make a textile fabric waterproof and yet preserve as much as possible its feel, finish, and appearance, says the Industrial Record, is one which is of interest in many mills. This process is not confined to woolen goods, but is practiced upon cottons, linens, and other kinds of cloths as well. Upon dress woolens, the intention is to make the cloth waterproof and yet leave it so that it will permit the escape of perspiration and the gaseous exhalations from the body. Overcoatings, wrappings, hunting goods, and goods of this class call for such treatment, and a few points as to the method of procedure may lead to good results. So far as known there is not one to which anything like universal employment is accorded, but one or two may be mentioned which are recognized as safe and good for the purposes named.

In the first place, as to the goods to be treated, no matter what may be their nature, it is an absolute essential to success that they be perfectly clean. If there is any sort of dirt upon the fibers of the cloth or in its meshes, dirt in the shape of oils, grease, animal products, vegetable materials, burrs, etc., the waterproofing material will act upon this dirt, not being able to get down to the body of the fibers composing the cloth, and just as soon as the dirt happens to be removed the waterproofing material is removed with it.

For a cotton fabric the following will be a good mixture: Take one pint of alum and dissolve it in hot water, also take one pint of sugar of lead and dissolve in water, then mix the two and use cold water until the whole stands at about 5° B. The clear liquid which is on top is applied to the goods, while the sediment is used in making another bath. For a woolen or part woolen fabric, take fifty quarts of animal glue and dissolve in water, add to this the same amount of potash alum and mix with water to suit the finish desired. This mixture is then applied to the goods upon the ordinary sizing machine. Then take two and one-half quarts of tannin and one quart of waterglass and mix with fifty quarts of water, and apply this to the goods at about 50° C. (122° F.)

The waterproofing is done upon a sizing machine, the cloth passing down into the material and up through the squeezing rollers, or sometimes passing only through the rollers and taking what material it can in the passage. The heavier the goods are, the more necessary will it be that they should pass through the mixture and get as much as possible of it into the body of the cloth.

The making of the mixture, the coloring of it to suit somewhat the color of the goods to be treated, the passage of the goods through it, and the subsequent drying constitute the main points in the process, the rest of the treatment being similar to that for ordinary cloths which are not waterproofed. There are many recipes in use for waterproofing fabrics, but those referred to here may be said to have been proved by experience to be suitable for the desired purpose.

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Iron and Steel at Welding Temperatures.

The following is an abstract of a paper by Mr. T. Wrightson, M. Inst. C.E., communicated to the Royal Society by Profes-or Roberts-Austen, C.B., F.R.S.

The object of this paper is to demonstrate that the phenomenon of welding in iron is identical with that of regelation in ice. The author recapitulates experiments made by him in 1879-80, described in the "Proceedings" of the Iron and Steel Institute for those years. These experiments were upon cast iron, and proved the fact that this form of iron possessed the property of expanding while passing from the liquid to the plastic state during a small range of temperature, and then contracted to the solid state, and that the expansion amounted to about 6 per cent in volume. The experiments were carried out under two distinct methods, the first being by the suspending of a cast iron ball on a spiral spring, and lowering the ball under the surface of a vessel filled with molten iron of the same quality; the change of volume was registered by the contraction of the spring as the varying displacement of the ball varied its buoyancy.

The second method was by casting 15 inch spheres of cast iron, and measuring the changing diameter as the spheres cooled, then laying down on paper a curve of changing volume, which in general character was found to be similar to the curves produced by the instrument used in the first method. This property of iron resembles the similar property of water in freezing, which, within a range of about 4° C., expands about 9 per cent of its liquid volume, and then contracts as the cooling proceeds. This property of water was investigated by Professor James Thomson and by Lord Kelvin. The former showed that from theoretical considerations there was reason to expect that in the case of a body exhibiting the anomalous property of expanding when cooled and contracting when heated, it should be cooled instead of heated by pressure or impact.

Lord Kelvin investigated the problem experimentally as affecting freezing water, and completely demonstrated the truth of his brother's reasoning. The experiments made by the author in 1879 and 1880 suggested the view that this property of ice was connected with the property of welding in iron, but this was only hypothetical, as the experiments had been made on cast iron, which probably, on account of the presence of carbon, does not possess the property of welding. Further, it was not practicable to experiment with wrought iron in the same way as with cast iron, on account of the difficulty of dealing with that substance in its liquid form. Professor Roberts-Austen has, however, given metallurgical research a recording pyrometer, and this has enabled the author to resume the investigation at the Mint, where he had the advantage of Professor Roberts-Austen's assistance and advice. The method adopted was the heating of bars in an electric welder, and as soon as the junction of the bars was at a welding temperature, end pressure was applied by mechanical power and the weld effected.

The temperature at the point of welding was observed by placing a thermo-junction at this point, consisting of a platinum wire twisted into a second wire of platinum alloyed with 10 per cent of rhodium. The electric current produced at the thermo-junction deflected a galvanometer, which by means of a mirror threw a spot of light upon a sensitized plate, which moved by clockwork uniformly in a direction transverse to the spot of light. This produced a curve, the ordinates of which represented time and temperature. These curves appear to show that a molecular lowering of temperature took place immediately the pressure was applied to the bar when in the welding condition. Photographic curves are exhibited which show that this fall in temperature varied in these particular experiments from 57° C. to 19° C., according to the circumstances of temperature and pressure.

This appears to prove that wrought iron at a welding temperature possesses the same property of cooling under pressure which was proved by Lord Kelvin to exist in freezing water, and on which demonstration the generally received theory of regelation depends. The author distinguishes the process of melting together of metals from that of weldings. Either process forms a junction, but the latter takes place at a temperature considerably below the melting point. The well known and useful property of welding iron appears, therefore, to depend, as in the case of regelation in ice, upon this critical condition, which exists over a limited range of temperature between the molten and the plastic state.

A Refractory Mixture.

M. Debois, of Reuleaux, France, has patented a mixture which, according to the Moniteur Industriel, when burned will withstand the highest temperatures. The mixture is composed of quartz or flint and sulphate of barium. The proportions are varied according to the needed resistance of the material, in some cases ground. Pudding stone is also added to the "mix." The mass when moistened will take any shape like ordinary fire clay, and is dried and burned in the same manner.

Four-Hundred-Foot Steamers.

The steamer Zenith City is one of the two 400-foot freight carriers being built by the Chicago Ship Building Company at South Chicago. This boat and the Victory, building at the same yard for the Interlake Company, a corporation made up largely of members of the firm of Pickands, Mather & Company, Cleveland, are to be practically duplicates. The Zenith City is to be owned by a syndicate formed by A. B. Wolvin, of Duluth, and which will include such well known vessel owners as David and Frank L. Vance, of Milwaukee, J. R. Irwin, of Painesville, O., F. N. La Salle, of Duluth, G. E. Tener, of Pittsburg, and John Green, of Buffalo. This is the boat that is to be fitted with Babcock & Wilcox tubulous boilers, while the duplicate steamer is to have two Scotch boilers, 14 by 13 feet, allowing 170 pounds steam pressure.

The Zenith City will be 380 feet keel, about 400 feet over all, 48 feet beam and 28 feet hold. She will have a water bottom of 54 inches. Her load from Lake Superior on present draught, 14½ feet, will be full 4,000 gross tons, and it is expected that, with a 20 foot channel a year or more hence, this will be increased in net tons to about 6,000. A feature of this boat and the Victory will be the big expanse of unbroken deck that they will present. Quarters for the crews as well as the dining room, steward's apartments, etc., will be located below deck. There will be no houses on deck, excepting the texas and pilot house forward. A turtle back covering for quarters forward will extend only to the rail, and the same will be true of the boiler house aft. Each boat will have eleven hatches, two of which will be located forward between the turtle back and the pilot house. Machinery for both the Zenith City and the Victory will be the same as that now in the steamer Kearsarge, and it will all be built by the Cleveland Ship Building Company. The engines will be triple expansion, having cylinders 23, 38 and 62 inches by 40 inches stroke.—Marine Review.

African Notes.

At a recent meeting of the Royal Geographical Society, Captain L. S. Hinde, of the Belgian service, read a paper on "Three Years' Traveling and Fighting in the Congo Free State."

The political geography of the Upper Congo basin under notice had been completely changed as a result of the Belgian campaign. It used to be a common saying, in this part of Africa, that all roads led to Nyangwe. The town visited by Livingstone, Stanley, and Cameron, until lately one of the greatest markets in Africa, had ceased to exist, and its site, when he last saw it, was occupied by a single house. Kasango, a more recent though still larger center, with perhaps 60,000 inhabitants, had also been swept away. It was represented now by a station of the Free State nine miles away, on the river bank. In harmony with this political change, the trade routes had been completely altered, and the traffic which used to follow the well beaten track from Nyangwe and the Lualaba, across Tanganyika to Ujiji, or round the lake to Zanzibar, now went down the Congo to Stanley Pool and the Atlantic. Despite their slave raiding propensities, the Arabs had during the 40 years of their domination converted the Manyema and Malela country into one of the most prosperous in Central Africa. The landscape, as seen from high hills in the neighborhood of Nyangwe and Kasongo, reminded one strongly of ordinary English arable country. There was nothing similar, as far as he was aware, in any other part of the Congo basin. In all parts of the virgin Congo forest he had visited wild coffee was so abundant and so excellent that the expedition left their tins of imported coffee unopened. The center of the Congo basin, through which stretched the 1,000 miles of navigable river and tributary, was an alluvial plain, rimmed in on all sides by rocky ridges, through which the rivers broke at points marked by falls or rapids. At some future time this vast ring of rapids might become a seat of a corresponding circle of mining centers.

At a meeting of the Linnean Society Mr. G. F. Scott Elliot, who had been absent from England since September, 1893, on a botanical exploration of Mount Ruwenzori and the country to the north of the Albert Edward Nyanza, and had returned home only on the previous day, gave an account of his journey and of the results, geographical, geological, botanical, zoological, and political, obtained by him. He took the route from Mombasa to Uganda. The country lying northeast of the Victoria Nyanza was described as a large rolling grassy plain some 6,000 feet above sea level, and well adapted for colonization. He went west from the Victoria Nyanza to Mount Ruwenzori, which is said to have an altitude of 18,000 feet, and spent four months in exploring that district under the great disadvantage of a dense cloud hanging over the mountain the greater part of the day, which often prevented the party from seeing more than 50 feet ahead. The sides of the mountain were clothed at the base with a thick growth of trees resembling the laurel of the Canary Islands; above that bamboos to the 10,000 feet level; and above that again what the explorer could only liken to a Scotch peat moss, into which the traveler sank at every step a foot or more. Large trunks like those of Erica arborea of the Canary Islands, but indicating trees 80 feet high, were noticed. Among other plants noticed were a viola, a cardamine, a gigantic lobelia, attaining a height of five feet or six feet, and a species of hypericum resembling that found in the Canaries; indeed, the similarity of the flora to that of the Canary Islands was remarkable. Mr. Scott Elliot ascended Mount Ruwenzori to the height of 13,000 feet, finding evidence of animal life and numerous insects to a height of 7,000 feet. Above 10,000 feet his Swali porters could not sleep without injury to their health, and it was only with a reduced number of men that he was able to ascend another 3,000 feet. Among the animals specially mentioned was a species of water buck (cobus), a new chameleon, a new snake, and several new insects. Mr. Scott Elliot's discovery that the Kagera River is navigable was regarded as important. Mr. Scott Elliott said he thought the route to Victoria Nyanza from the mouth of the Zambesi, by way of the Lakes Nyasa and Tanganyika, would most advantageously open communication between the Upper Nile and the coast at Chindi, and thus do more for international interests than could be expected to result from a railway from Mombasa.

Helium.

Lord Rayleigh, who so recently discovered "argon," a new constituent of the atmosphere, has succeeded in finding helium in a Norwegian mineral. This substance was believed to exist only in the sun and in a few stars. There are indications that the sun contains a few elements which an analysis of the substances composing the crust of the earth has failed to reveal, as "coronium," a line in the green part of the spectrum of the outer solar envelope which is thought to represent a gas lighter than hydrogen. This line is numbered 5,316 in the Rowland scale and 1,474 in the old Kirchhoff scale. In examining the layer of gas below the corona spectroscopists have discovered a brilliant yellow line which was formerly called "D 3," and which is situated at 5,876 on the Rowland scale. Examinations of terrestrial substances have not revealed this element heretofore, so that it was regarded as peculiar to the sun and a few stars. This substance was known as helium. Lord Rayleigh was testing a Norwegian rock specimen with sulphuric acid and a gas was evolved. This he found to consist largely of argon, but combined with it was another gas which he succeeded in identifying with the spectroscope as helium. Prof. Crookes has confirmed his conclusions. The same rock has been treated in the same way before, but the gas evolved has always been considered to be hydrogen until Lord Rayleigh made his brilliant discovery.

From its associations and the particular region of the sun where helium is found, this gas is looked upon as being one of the lightest materials composing that body, possibly almost as light as hydrogen. Nilsing is inclined to think that helium resides chiefly in the upper portion of the chromospheric sheet. This suggests the idea that, like coronium, it may weigh less than the gas with which it is associated. The researches of Gruenewald indicated that possibly both helium and coronium were components of hydrogen partially disassociated by the intense heat; but Lord Rayleigh's discovery of the gas in combination with argon at an ordinary temperature tends to discredit this theory.

The Swiss Watch Schools.

The famous Swiss watch schools are said to be the most exacting industrial institutions in the world. Their methods, which are doubtless the secret of their success, will be found very curious and interesting. In one of the most celebrated of these institutions in Geneva, for example, a boy must first of all be at least fourteen years of age in order to enter. After being admitted, the student is first introduced to a wood turning lathe, and put to work at turning tool handles. This exercise lasts for several weeks, according to the beginner's aptitude. This is followed by exercises in filing and shaping screwdrivers and small tools. In this way he learns to make for himself a fairly complete set of tools. He next undertakes to make a large wooden pattern of a watch frame perhaps a foot in diameter, and after learning how this frame is to be shaped, he is given a ready-cut one of brass of the ordinary size, in which he is taught to drill holes for the wheels and screws. Throughout this instruction the master stands over the pupil directing him with the greatest care. The pupil is next taught to finish the frame so that it will be ready to receive the wheels. He is then instructed to make fine tools and to become expert in handling them. This completes the instruction in the first room, and the young watch maker next passes to the department where he is taught to fit the stem-winding parts and to do fine cutting and filing by hand. Later on he learns to make the more complex watches which will strike the hour, minute, etc., and the other delicate mechanisms for which the Swiss are famous.

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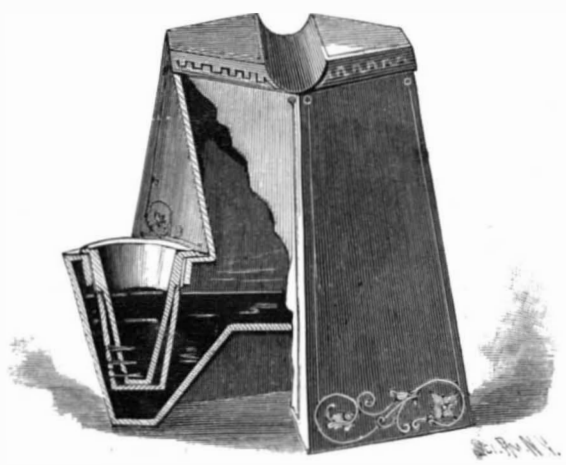
AN IMPROVED INK WELL.

The illustration represents, in perspective with a broken-out section, an ink well that is not easily tipped over, which is designed to prevent dipping the pen too deeply into the ink, and to hold the ink in the well proper always clean and free from sediment. The improvement has been patented by Mr. John Black, of Trafalgar Street, Nelson, New Zealand. The main reservoir has a raised bottom, in the front side of which is a depression with tapering inner and outer walls, adapted to receive a removable double-walled well, having preforations near its bottom through which the ink flows slowly from the reservoir.

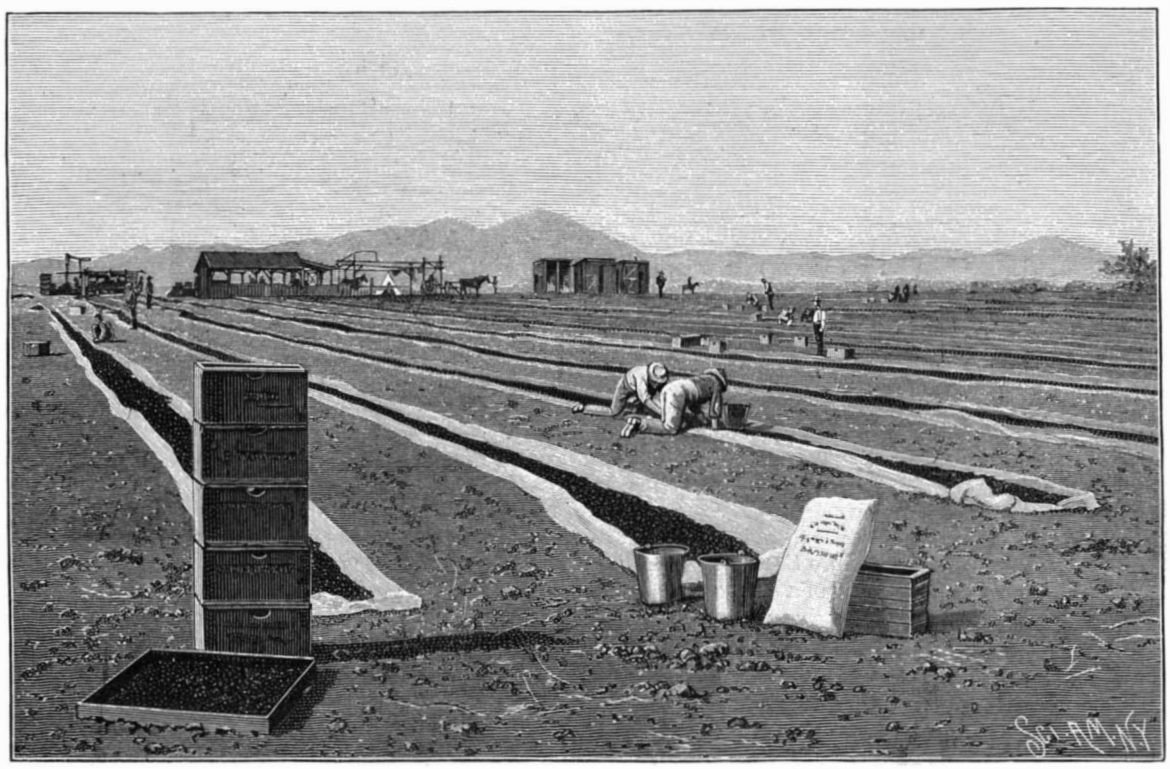


BLACK'S INK WELL.

On the outside of the removable well is a vertical groove, admitting air to the reservoir, and by regulating the thickness of the top flange of the well the height to which the ink rises in it may be determined. Above and back of the well is a recess to provide room for the fingers in dipping the pen, and in the top is a transverse groove to receive the pen when not in use. It is apparent that the removable well is kept fully supplied as long as any ink remains in the reservoir, and the point of the pen is protected from settlings.

CALIFORNIA SUN DRIED PRUNES.

California has given us an enormous supply of fruit, which by recent improvements is able to reach Europe in good, wholesome condition. Our engraving, which is from the Illustrated London News, shows the process of drying prunes. Wide strips of linen are laid on the ground, and on them are placed the newly picked fruit. The hot sun accomplishes the drying in a short while, and then the prunes are carefully packed for traveling, and are transported from the fields to be relished in all parts of the world. From recent statistics it appears that California produces at least 26,000,000 pounds of raisins annually. There are more than 200,000 acres in California under vines, and these yield nearly 15,000,000 gallons of wine.



PRUNE DRYING IN CALIFORNIA.

Incinerated Leaf of Deutzia.

At the annual exhibition of the Department of Microscopy of the Brooklyn Institute, held in January, Mr. Geo. M. Hopkins, of the SCIENTIFIC AMERICAN, exhibited a beautiful preparation of Deutzia leaf, which seems to have the merit of novelty. The leaf was reduced to white ashes, leaving the star-like hairs in situ. Some of the hairs were blackened by the carbon of the leaf, others were white, with pearl colored nodules ranged along the rays of the star, like so many real pearls.

Mr. Hopkins' method of preparing this object is as follows: A small piece of the dried leaf is placed upon a thin, flat copper plate, and another flat copper plate is laid upon it to keep it straight. Strong pressure is not required. The plates are now heated slowly over a flame until they become red hot; they are then allowed to cool, and the upper plate is removed. The piece of leaf is found to be carbonized and considerably shrunken. Without replacing the upper copper plate, the lower plate with the carbonized leaf is again brought to a red heat, and lastly the flame is brought into actual contact with the leaf, thus removing the last trace of carbon, leaving nothing but the stars and the white ash.

The object is very tender, but it may be handled with proper care and may be mounted dry. If it is desired to secure the stars separate from the ash, one or two incinerated leaves may be placed in a small metallic box and shaken up until the leaf is disintegrated, when the stars may be picked out.—The Microscopical Bulletin.

Microscopical Analysis of Steel.

At a recent conference, held under the auspices of the French Society for the Encouragement of National Industry, M. Osmond; described a method for the microscopical analysis of steel. The method proposed comprises, in addition to the preliminary process of preparing the polished surface, three operations: (1) Polishing in bass-relief on parchment with a very small quantity of English rouge mixed with water; (2) etching and polishing on parchment with a mixture of calcium sulphate, in precipitate, in a suitable vehicle; and (3) etching with tincture of iodine and nitric acid. These three operations enable one to recognize in the steel five constituents. These five constituents are associated in combination to form the complex edifice of the structure of steel. M. Osmond examined four types of steel, possessing a known proportion of carbon, to discover the manner in which these combinations varied. As a result of that investigation, M. Osmond states that the thermic treatment of the steel leaves in the structure of the metal, when cooled, characteristic indications sufficiently precise to form a useful guide in the manufacture of steel, and also to enable consumers to determine the quality of the metal supplied to them.

Suppression of Bone Black.

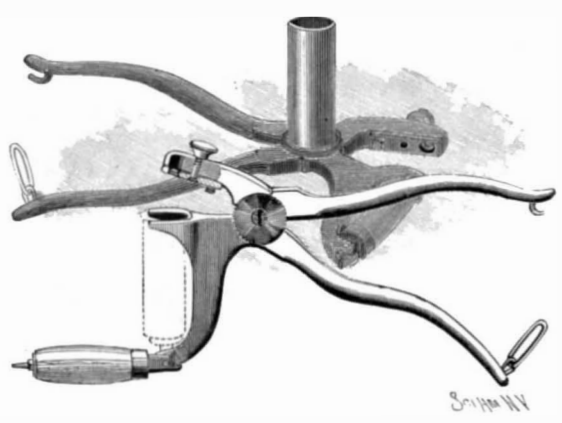
Bone black in beet sugar making and refining is, says the Sugar Beet, rapidly becoming obsolete. Manufacturers at first hesitated to believe that any other process for the clarification of saccharine juices could give equally satisfactory results. Facts as they now stand show that most of the sugar experts have been convinced that mechanical filtration means greater economy and an equal clarification. Most European refiners do not use more than 10 pounds bone black per 100 pounds sugar worked, and within the next few years, as a certainty, even this will be abandoned.

Of all the excellent methods for suppressing bone black Dr. Soxhlet's may be considered the best. There are some features of it that resemble the Casamajor process; it acts mechanically and has no decolorizing effect upon the sirups filtered. The facts seem to show that the product obtained is so pure that no other manipulation is necessary but graining in pan. The filtering medium consists of a thoroughly washed powder made out of fossils, to which is added an equal quantity of fine sawdust. The raw sugar is melted and cold water added, so that the consistency is 65 degrees Brix. To this must be added 0·1 per cent of the fossil in sawdust mixture; the whole is then forced through a filter press. The first filtrate has a troubled appearance, but after that the sirup filters clear for at least 15 hours.

The masse cuite obtained by this method should have purity of 99·6, equal to that of any product obtained by a bone black method. It is interesting to note that the economy by this method is not only in the saving of bone black, but a considerable reduction in sugar losses that occur in the old method of filtration.

A RELOADING TOOL FOR CARTRIDGES.

The illustration shows a simple tool, patented by Mr. D. A. Ripley, for preparing shells for shot guns and other arms, in applying caps and removing them, removing the primers from the shells after they have been fired, and quickly adjustable for use in applying new primers or caps to the shells. The improvement is being introduced by Mr. W. P. Lewis, of Center Belpre, Ohio. A recessed shell base at the joint of the tool provides for the convenient placing of the shell to be reloaded, as indicated. The lower jaw has a forked upper portion, and a depending curved arm in which is pivoted the shank of a shell holder and guide, which is swung outward to receive the shell, and turned up, as indicated by dotted lines, when a



RIPLEY'S CARTRIDGE RELOADING TOOL.

cap or primer is to be ejected by the punch on the outer end of the holder. On the under side of the upper jaw is held a swivel plate, by means of a screw and thumb nut, the plate having near one end a hole registering with a hole in the jaw and also with the punch. On this plate is also a boss, slightly larger than the primer or cap of the cartridge shell, the boss being concaved on its under side and adapted to push the cap or primer to its seat, the plate being turned around for this purpose, and adjusted, by means of the screw and thumb nut, with the boss beneath the hole of the upper jaw and above the primer hole of the cartridge. The shoulder of the shell being thus recapped rests on the arms of the fork of the lower jaw as the handles are pressed together. To hold the handles closed when the tool is not in use, one handle has a hook and the other an engaging link.

Importance of Systematic Exercise.

It has always seemed to us a grave mistake that physicians in general have not studied the subject of exercise much more thoroughly and systematically, and thus direct their patients more carefully and intelligently. Many physicians simply say to their patients that exercise will be of benefit, but go no further than this. Directions of this meager and superficial nature are of no real value whatever.

A variety of exercises is probably the best way. We must try and get exercises which will interest and stimulate the mind. It seems to us that the very best single sport is fencing. It can be done in all seasons of the year; it is excellent for both sexes, young and old. This exercise is very absorbing and stimulating, and can be much better regulated and systematized than sparring, wrestling, bicycling, and many other sports, which are not entirely mechanical.

In fencing, we learn self-reliance, agility, grace, and rapidity of thought; and it is comparatively free from many of the dangers we meet in sparring, wrestling, etc. It brings a large number of muscles into play, and makes them supple and extremely quick.

Pupils are taught to fence with both arms equally well; the chest always being thrown well forward. It can be carried on in well ventilated rooms or out of doors in moderate weather.

The fact that fencing can be so well regulated and systematized makes it an ideal exercise from a medical standpoint.—Med.-Surg. Bulletin.

A SCIENTIST has recently declared that the average speed of the transmission of the shock of an earthquake is 16,000 feet per second.

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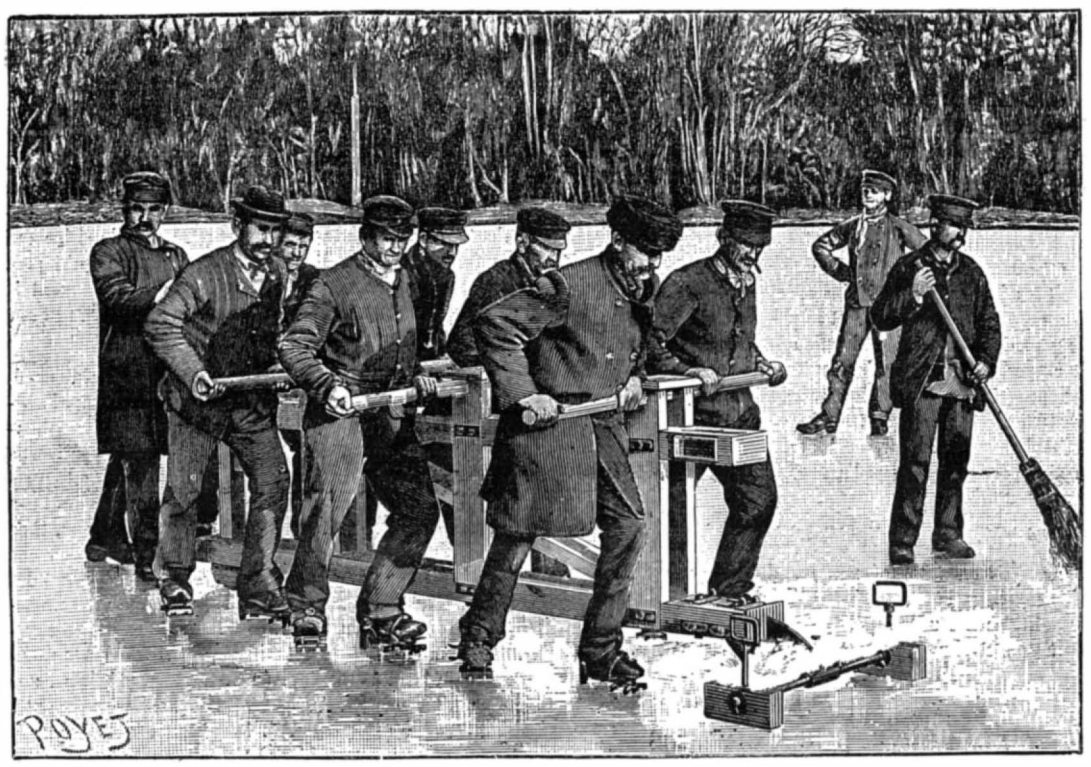
THE ICE PLANE.

When severe cold comes on suddenly in calm weather the lakes and ponds rapidly freeze, and the surface, which is as smooth as that of a mirror, makes the hearts of the lovers of skating glad. But it sometimes happens that the wind intervenes during the period of cold necessary for the formation of ice, and the motions given the sheet of water produce an irregularly frozen surface that presents changes of level of several inches, which are very troublesome to the skater. Upon rivers, where the complete solidification of the mass of liquid scarcely occurs until after a drifting of some days, the irregularities are still greater. An apparatus—a sort of large plane—has been devised for removing such irregularities and smoothing the ice, so as to adapt it for the exercise of skating, whatever be the conditions, moreover, under which the congelation has taken place. This apparatus, called a "glaciplane," we have seen used upon the skating pond of the Bois de Boulogne, at Paris, and have thought that it might render service elsewhere if it were better known.



ICE PLANE USED UPON THE FROZEN LAKES OF THE BOIS DE BOULOGNE.

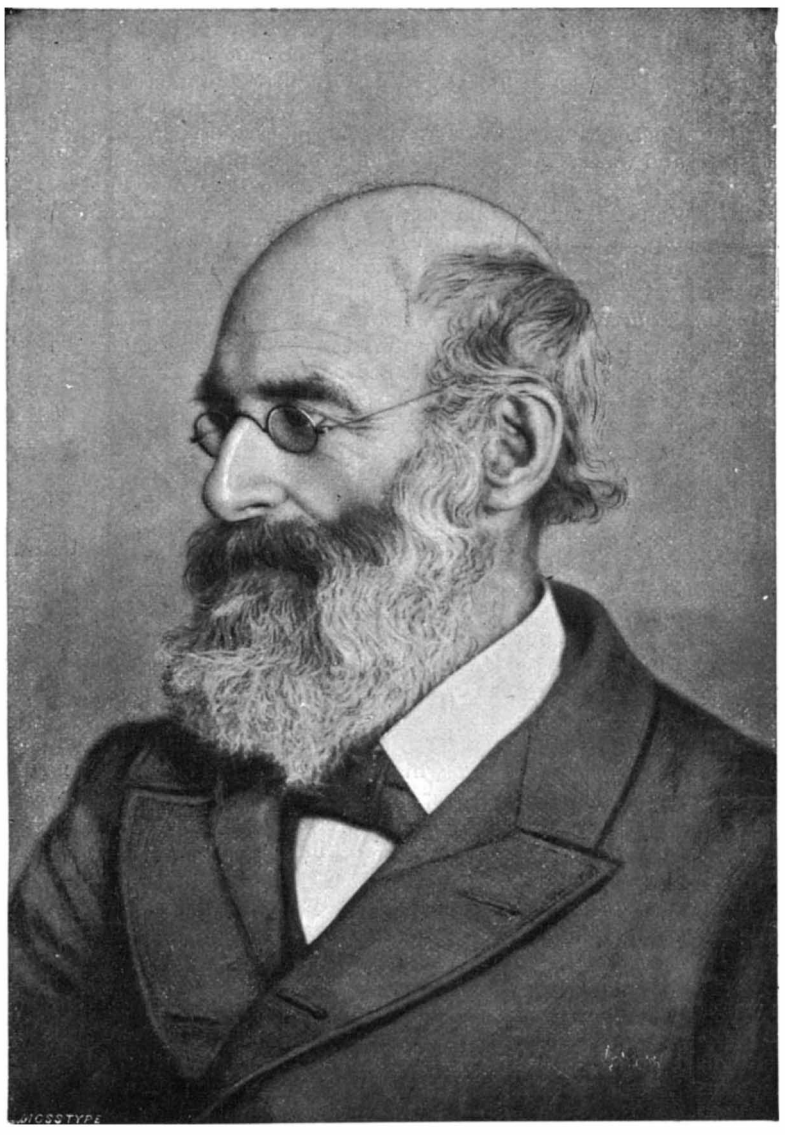
As shown in the accompanying engraving, the system consists in pushing forward a steel blade properly inclined to cut away everything that exceeds the desired level.

This blade is mounted in front of a wooden frame provided with crossbars that allow six men to push it, while at the same time bearing upon it slightly. The inclination of the blade is regulated by means of set screws that serve for mounting it, and afterward by causing the general position of the frame to vary with respect to the plane of the ice. To this effect, the rear rests upon the frozen surface through a single point only, a sort of wooden shoe, which, by means of a small winch, may be lifted to a varying degree. A man standing in the rear attends specially to this work, while another one, by means of a bar, does the steering. In order that an adequate thrust may be given, the men whose duty it is to maneuver this gigantic plane are provided with special calks, which are fixed against the sole of the shoes by straps. These calks consist of a piece of iron whose bottom is provided with blades toward the heel and toe, and which is jointed in such a way as to allow the foot to have a certain amount of flexibilty and to move without fatigue.

With a force of strong and well trained men it is possible in a few hours to render a very bad sheet of ice sufficiently level to allow skaters to perform their evolutions thereupon easily and without danger.—La Nature.

ROYAL E. HOUSE.

We republish from the SCIENTIFIC AMERICAN the portrait of the distinguished inventor, Royal E. House, whose decease, at the age of 81 years, we have already chronicled. The following interesting account of his achievements is by Mr. Franklin L. Pope, and is from a recent number of the Electrical Engineer: Royal Earl House, who died at his home in Bridgeport, Conn., on February 23, at the advanced age of 81, was, in many respects, one of the most remarkable of the galaxy of American inventors whose achievements have rendered the annals of the nineteenth century illustrious. In the limited space at disposal, it is impossible to give more than the briefest outline of his singularly interesting career. Born in Rockingham, Vermont, September 9, 1814, he removed, while yet young, with his parents to Choconut, a small hamlet in Susquehanna County, Pennsylvania, a point farther remote from civilization at that date than is Alaska to-day. His inventive talent first manifested itself in the construction of a submerged water wheel for a saw mill, which embodied a principle since used in many forms, and known as the "scroll wheel." Early in the forties, he went to Buffalo, N. Y., with the design of studying law with a relative of his family residing there, but having gained access to a limited number of scientific books, he became interested in electrical researches, and these soon became the absorbing passion of his life. Returning to his home, he conceived and worked out in his own mind, without the slightest knowledge of what had been done by others, the scheme of an electric telegraph. From the outset, his design was to produce a record in printed Roman characters, and all his efforts were devoted to that end. He possessed the unusual and remarkable mental capacity of originating and designing the most complicated mechanical structures, in all their parts, details, combinations and dimensions, without embodying them in models, drawings or other tangible form. In this way he thought out his first printing telegraph, which was adapted to work with two independent circuits, one of which was made to turn a type wheel step by step, while the other served to give the impression of each successive letter then presented, precisely as is done in many of the more recent "stock tickers." Having fully completed the design in his mind, House came to New York and had his machine constructed piecemeal at two or three different shops, afterward assembling the parts together with his own hands. This apparatus was exhibited in successful operation at the Fair of the Mechanics' Institute, of New York, in the basement of the City Hall, in the fall of 1844, only a short time after the establishment of Morse's first line between Baltimore and Washington, and long before this had been extended to New York. Mr. William Ballard became interested in the invention, and furnished House with the necessary means to perfect the invention. When completed, which was not until several years afterward, it proved to be a perfect marvel of mechanical skill and ingenuity, and was demonstrated to be capable, under favorable conditions, of printing messages in plain Roman characters at the rate of more than fifty words per minute. Capitalists ultimately became interested in the scheme, and between 1847 and 1855 an extensive range of telegraph lines was erected, extending from New York along the seaboard to Boston and Washington, and west as far as Cleveland and Cincinnati, on which the House instruments were employed with great commercial success. Many original details of the line construction were designed and carried out by Mr. House, and, viewed in the light of later knowledge, they stamp him as an electrician whose practical attainments were vastly in advance of his time. He preferred to employ stranded wires of great conducting capacity, insisting that a much higher speed of transmission by his system could be obtained in this way than by means of solid wires of equal resistance, a theory which was scouted by electricians for nearly half a century, but which is now universally admitted to be true. He designed and constructed the first successful long span river crossing at Fort Lee, in 1849, carrying two piano wires on masts 400 feet above the Hudson River, in a span of over 4,000 feet; thus for the first time establishing permanent telegraphic communication between New York and Philadelphia. He designed an insulator having a glass screw-socket to engage with a thread cut upon the top of the pole. When the glass manufacturers insisted that it was impossible to make it, he at once designed a machine for performing the operation, which, in its essential principle, is in use to this day. By his wonderful powers of observation and invention, he was able to overcome every difficulty as it came up, and no electrical or mechanical problem ever appeared to baffle him. Suits were brought in 1849 by the owners of the Morse inventions against companies using the House machine, alleging infringement of their patents, but the combined technical and legal skill of Counselor George Gifford, the forensic pyrotechnics of Rufus Choate, re-enforced by the consummate expert knowledge of House himself, were too formidable an opposition to be readily overcome, and in June, 1850, in the United States Circuit Court, in the District of Massachusetts, Judge Woodbury announced his famous decision, refusing an injunction; a most notable victory for the eminent inventor and his associates, especially relished by House in view of a remark which had once been made by Francis O. J. Smith, one of the principal owners of the Morse patents, that he could drive his old Durham bull from New York to Boston with a message tied to his horns quicker than it would ever be sent by House's printing telegraph.



ROYAL E. HOUSE.

After the general consolidation of competitive telegraphic interests, which took place about 1860, the House apparatus gradually went out of use, the simplicity and cheapness of the Morse system, and more especially the vast improvement in the skill, rapidity and accuracy of the operators over those of early days, rendering the use of the latter more profitable to the companies. Mr. House himself, in possession of a competency acquired from his invention, removed to Binghamton, N. Y., where he lived in comparative retirement for many years. In 1865 he appeared at the Patent Office with a most elaborate and ingenious system of automatic sound telegraphy, obviously the fruit of years of laborious study, and embodying features which have proved of extraordinary value in other systems of intercommunication, but which, as a whole, never met with the acceptance of the commercial telegraphic interests of the country. About ten years

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since he removed to Bridgeport, where he passed the remainder of his days.

Mr. House possessed keen powers of observation, great originality of mind, and extraordinary tenacity of purpose. He was a man of vigorous physique and attractive personality. He was in full possession of his faculties to an advanced age, and retained in his memory the minutest details of his diversified and eventful life. His first patent bore the early number of 1,200; his last was No. 533,600.

THE MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.

Without doubt, electric lighting by incandescence is the perfection of artificial illumination, since it offers light of the desired quality without developing an objectionable amount of heat, and without vitiating the air, while it is practically free from fire risk.

It is unnecessary in these days of electrical literature to devote time and space to historical matters, and it would be equally superfluous to extol the inventors and the invention.

This article and the annexed illustrations are published for the purpose of giving to the general reader a knowledge of how incandescent electric lamps are made. Our sketches were taken from the extensive manufactory of the Swan Lamp Manufacturing Company, in Cleveland, Ohio, and it is through the courtesy of Mr. S. M. Hamill, president of the company, that we are enabled to present the facts and sketches.

It has been found cheaper and generally more satisfactory by lamp manufacturers to buy the blown glass bulbs from glass factories. These globes are sent to the lamp makers in the form shown in Fig. 2, in which is shown a bulb having an elongated open-ended neck. The first operation in the work of making a lamp is to perforate the bulb at the end, by heating it and forcing a small rod through it from the inside. A short piece of glass tubing having a diameter of about $\frac{3}{32}$ of an inch is fused to the glass, and the tube for a distance of about $\frac{5}{8}$ of an inch from the globe is reduced in diameter, leaving a small passage through which the air is removed from the lamp in the operation of exhausting. Attaching the tube in this manner is termed "tubulating."

At another table, as shown in Fig. 2, the carbonized cellulose filament is subjected to a process called "flashing." The girl having this in charge attaches the carbon ends to suitable pincers projecting from one side of a rubber disk, the pincers being connected with the wires carrying the current for heating the carbons. The carbon filament is plunged downward into hydrocarbon vapor, when the current is sent through the filament, heating it to incandescence, while it is surrounded by the vapor. The vapor is decomposed by the heat and carbon is deposited on the filament until it acquires the proper resistance, when the current is automatically cut off. Platinum leading-in wires having a cup at one end, made by flattening the wire at the end and bending it around a "former," are inserted in short glass tubes, 4. Two of these are connected together by a solid cylindrical "bridge" piece, 5, thus forming the mount, 7. The operation is shown in 12. The filaments, cut to the proper length, are then inserted in the cup shaped ends of the leading-in wires, and cemented with carbon derived from naphtha by a current of electricity, thus completing the mount and filament, 8.

Short pieces of copper wire, 9, are then soldered to the free ends of the platinum wires. The completed mount and filament is now introduced into the bulb. A girl twirls the elongated end of the bulb in a flame, seizes the end of the mount with tweezers, and gradually closes the lower end of the bulb around the lower end of the leading-in wire tubes, fusing them together and properly disposing the filament in the center of the bulb; this is shown in Fig. 10, and is termed "sealing and sinking."

Three such bulbs are now taken to a Sprengel pump and the air is exhausted by a stream of mercury, so directed and subdivided by its fall through a glass tube as to gradually pull out all the air from the bulb. The attendant is enabled to judge the progress of exhaustion by the size of the mercurial drops, and when their diminished size indicates nearing the finishing point, the current is turned on to heat and rarefy the remaining air and assist in the more complete exhaustion. A flame from a Bunsen burner is then directed against the reduced portion of the glass tube, fusing the glass and thus sealing the globe. This operation is shown in Fig. 13.

To complete the lamp now requires only the attachment of the brass cap and making the proper connection with the little copper wires. The caps are made fast to the bulb with plaster of Paris, as shown at 14. This operation is termed "capping."

The Swan Lamp Manufacturing Company's works are on Belden Street, Cleveland, Ohio. They have a capacity of 2,500 lamps per day, the lamps having a voltage of from 40 to 125 volts. Lamps made at these works are guaranteed an existence of 1,000 hours.

Water in Steam Pipes.

In a discussion upon steam piping, at one of the recent meetings of the American Society of Mechanical Engineers, Professor Thurston made some interesting comments. Every one will recognize the fact that the two and sufficient principles to be adhered to in designing lines of steam piping are, first, to provide for contraction and expansion; and secondly, to provide against standing water anywhere in the line of the outside or inside. If the pipe can be arranged so that the expansion or contraction can take place without causing stress of the material, and if it can be kept dry inside or out, no difficulty will arise. It is not well understood that the strains that may be produced in a pipe by water are very severe. These are very serious and severe and sometimes fatal, the results of settlement of water in a steam pipe, that may act by condensation of steam causing water hammer, or may be precipitated in such form that it may be carried over as a slug to strike where it will and act like a hammer.

An early experience of this sort is related by Professor Thurston. Steam was carried from the boiler room adjacent, down the opposite wall and under the floor, a distance of several feet, then up to the steam chest of the engine. In the U thus formed was placed a cock, to be opened for draining it, by the engineer, whenever the engine was stopped, and to be closed when the engine was running. It happened that one morning the engineer was not in the room at seven o'clock, and his assistant came in and at once stepped to the throttle valve, which was set in the pipe lying against the wall, at the point where the steam entered the U on the way to the engine. The instant he opened the valve there was a crash; the cast iron steam pipe was broken below the floor. He went below and found the engineer dead, having been killed by the exploding pipe. He had gone down to set up a joint which had probably been loosened by this very action. This fact illustrates either the force which water may exert when forced through a pipe by the impelling power of steam, or the forces that may be set in action by the sudden contraction of a moving mass of steam when coming in contact with a mass of cold water. Either action would have been sufficient for the result described.

Another instance was mentioned where the steam pipe was not sufficiently drained, and the water collected in the pipe and was carried over into the cylinder of the engine, wrecking it. Large stresses must be produced, and it would be interesting to observe how large these stresses are. No one has yet found a way of ascertaining them accurately. The fact that such accidents do occur, unquestionably due to the impact produced by the rapid condensation of steam on the surface of a pool of cold water, shows that these stresses must be enormously great. What may happen when a rapidly moving, heavy mass of solid water, in full career, strikes an obstruction we all know; but the hammering of steam in pipes produces a local strain probably quite as severe, perhaps even more serious.

This second kind of strain is known to be enormously great, but how much we do not know. He had occasion once to examine a quantity of pipe taken out of a heating system then in operation, but now extinct. He was informed that the pipes were defective and was asked to examine them for the purpose of obtaining a report to secure from the makers a reduction of their cost and possibly damages. Many of the pipes were split through good welds and bad welds, through solid iron even, and the only report he could make was that they were injured by water hammer. A quantity of the pipe was taken to the mill where it was made and the pressures they would stand were measured, split and weakened as they were. In order to obtain a fair idea of the actual pressures that the pipes would sustain, a rubber packing was arranged on the inside of each pipe, a strip covering each crack from end to end, drilling a few holes along the crack, so that the strength of the pipe should not be affected and to insure that sealing these joints should not affect the strength of the pipe. The bolts simply held that packing up against the crack on the inside, so as to seal it by the slight pressure of a line of small bolts which were put in simply to hold the packing in place. Pipes arranged in this way, and tested in the hydraulic apparatus of the mill, carried all the way from 300 to 1,000 pounds pressure to the square inch, injured as they were. The conclusion was obvious that the water hammer to which they had been subjected was enormously in excess of these figures, representing the strength of the pipe after the crack had been made. These facts are more impressive than any possible examination, without actual measurement of these quantities, and reveal the intensities of the strains that occur, and the risks of danger which occur from allowing water to stand anywhere in a pipe. After water had once collected in a pipe, especially in steam pipes leading to engines of larger size, there is no safe way of removing this danger except by simply shutting the steam off at once, if it is moving in the pipe, or keeping the throttle shut, if it is not moving; then let the steam down and drain the pipe completely before steam is again put on. If an attempt is made to drain even a still pool of water in a pipe under pressure, the water hammer may become very severe. The disturbance of the pool by the flow of steam causes condensation; condensation causes a rush of steam upon the surface of the water, and presently there may result as serious effects as when steam actually moves through the pipe with the throttle valve open, and the pool of water is set in motion to cause accident by impact.

Aluminum Alloys and Solder.

The solder consists of silver, nickel, aluminum, tin and zinc, in the proportions as follows:

	Per cent.
Silver	2
Nickel	5
Aluminum	9
Tin	34
Zinc	50

No flux is necessary, and any soldering iron or tool may be used, though one of aluminum is preferable.

The alloy consists of copper, tungsten, aluminum, tin and antimony, for either of the two latter manganese or nickel being at times substituted. The proportions preferred are somewhat as follows:

	Parts.
Copper	0·375
Tin	0·105
Antimony	1·442
Tungsten	0·038
Aluminum	98·040
	100·000

Tungstic acid and cryolite are melted together, equal proportions being employed. When the temperature reaches 1,200° C., aluminum is added so as to produce a 10 per cent compound of aluminum and tungsten. A second alloy is made containing equal proportions of aluminum and copper. These two alloys are then melted together with pure aluminum in the proper proportions to form the alloy required as above; tin, antimony, or their substitutes being added in the necessary proportions; or they may be left out altogether when the copper and tungstic acid originally employed are chemically pure.

Another alloy consists of aluminum, silver and copper, preferably in the following proportions or approximately so: Aluminum, 96·25; silver, 3·50; copper, 0·25 per cent = 100·00.

Medical and Surgical Aspect of the Japanese War.

Great progress has been made in Japan in medicine, and especially in military surgery, in the last few years. The surgeon-general has pointed out that the mortality among the wounded in the Satsuma war was 17 per cent, while in the present war it has dropped to 4 per cent. The armies of Japan are accompanied by 1,350 medical attendants, of whom 380 are surgeons. The barrack hospitals in Japan are large, and are equipped with the latest appliances.

The largest of these hospitals is at Hiroshima. The staff consists of 56 surgeons and 501 nurses, in addition to 173 surgeons and nurses from the Red Cross Society, in which many representatives of the Japanese nobility serve. The same society has 138 practitioners and nurses in the field. The remarkable results which have been obtained in the present war in Japanese surgery, medical practice and sanitation are largely due to Dr. Kitasato and other pupils of the great medical schools of Germany.

Dr. Kitasato was one of the most eminent of Dr. Koch's students and was associated with Dr. Behring in some of the researches which culminated in the discovery of antitoxine.

The army of Japan has been fortunate in regard to disease as it has been in the results of its numerous encounters. The London Times states that the combined mortality from disease and the loss in battle has only been about 1,300 lives out of the armies, which number 50.000 men, and the navy, which consists of 29 ships. The comparative immunity from sickness is believed to be largely due to the rice diet. It is probable that such achievements were never before realized in the history of warfare with so small an expenditure of human life.

English Express Trains.

The present exhibits some striking accelerations compared with ten years ago. The broad gage is gone, and the "Cornishman" has superseded the "Dutchman" and "Zulu" as the fastest G. W. train to Exeter. The timing is: Paddington, depart, 10:15 A. M.; Swindon, arrive 11:42, depart 11:52; Bristol, arrive 12:45, depart 12:52; Exeter, arrive 2:20. The up leaves Exeter 3:40, and makes exactly the same time over every section. With only the two stops 194 miles are covered in 228 minutes, or upward of 51 miles per hour. A train now leaves Birmingham at 8:45 A. M., and reaches Euston at 11:10, a speed, with three stops occupying seven minutes, of 49·1 miles an hour. The London and Southwestern now runs the 79 miles to Southampton West in 98 minutes without a stop, the 12:30 P. M. down doing this at 48·3 miles an hour.

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Correspondence.

"The Mechanical Color Tests."

To the Editor of the SCIENTIFIC AMERICAN:

Having read with special interest the recent articles which have appeared in your columns regarding "The Mechanical Color Tests," and noting the fact that my name has been used in connection with them, I venture to ask that you will allow me space for a very brief explanation of my relation to the subject. Owing to my connection with the kindergarten since its earliest introduction in this country, my attention was called, many years ago, to the utter lack of any logical system of color instruction, and for a long time I gave this subject much thought without discovering the means for any radical improvement.

As early, however, as 1885 I had arrived at the conclusion that, owing to the fugitive qualities of pigmentary colors and the indefiniteness of their commercial names, the solar spectrum affords the only source from which to derive unchangeable standards of color; also that the Maxwell disks furnish the only practical means for measuring color effects produced by material substances, and that from these two sources a practical color nomenclature was possible.

Following out these ideas by continued practical demonstrations with the aid of many friends in the educational field, we selected, in 1888–89, six locations in the solar spectrum best adapted, in our opinion, to supply these standards. We also prepared Maxwell disks in the closest possible pigmentary imitation of these six standards and black and white, thereby rendering possible a nomenclature of colors. A little later these spectrum standards, which had been chosen æsthetically by competent colorists, were located by their wave lengths by a professional scientist.

This scheme of color instruction was definitely formulated and carefully explained at considerable length in a book published and copyrighted in 1890, called "Color in the Schoolroom." This book outlines a practical system of color instruction based on spectrum standards æsthetically selected and scientifically located. When the purest possible pigmentary imitations of these spectrum standards were applied to the Maxwell disks and rotated on a color wheel or color top, they furnished the first practical nomenclature for material colors ever put in use. After a test of five years this nomenclature has proved of such educational value as to gain the approval of a very large number of the leading educators and art teachers of the country.

Since 1890 this system of color teaching has been greatly improved, having been kept constantly before the public in the scientific and educational papers, by means of numerous addresses to teachers, normal schools and colleges, and in two other books which the writer has published since the one mentioned above.

Springfield, Mass. MILTON BRADLEY.

An Answer to Strindberg.

To the Editor of the SCIENTIFIC AMERICAN:

In the March 23 number of your valuable paper I noticed an article by Strindberg on the "Inferiority of Woman." If the editor will permit, I would like to make reply to that article through your journal.

The first sentence under the above heading is this: "Woman is inferior to man." He goes on to prove this statement by saying, "The author of 'Pere' does not arrive at this conclusion by an exclusive analysis of woman's mental qualities; to a great extent he relies upon her structural and anatomical weaknesses."

In the second chapter of Genesis, seventh verse, we read: "And the Lord God formed man of the dust of the ground." In the same chapter, twenty-first and twenty-second verses, we read: "And the Lord caused a deep sleep to fall upon Adam, and he slept, and he took one of his ribs, and closed up the flesh instead thereof, and the rib, which the Lord God had taken from man, made he a woman." He speaks of the gray matter of the brain not being so dense in the female as in the male. Yet, in the next sentence admits that her nerves are much stronger, nine pairs of much stronger nerves in the female than in the male emanating from this inferior brain of the female. The author of that article evidently traces his origin to the inferior animal. How much rather would I believe the second chapter of Genesis and meditate upon my origin as from God. This inferior little body of mine being framed by God from the bone or rib of this superior being spoken of, man. Yet Adam, when woman was brought unto him, said: "This is now bone of my bone, and flesh of my flesh."

Man, with his superior strength and muscles (which we admit), has not the nerve or courage to endure suffering. As we attribute largely man's superior strength and the developed muscles to the difference of duties or occupation of men, so do we attribute to woman a greater capacity to endure pain; simply because God made woman to bear and nurture the race. In the burial places of the stone and iron ages the writer claims skulls were found of two different kinds. He says it is opined that the inferior skulls were those of the female; the superior, those of the male. It is as reasonable to suppose that the inferior were those of the male, and the superior those of the female.

And again it is just as reasonable to suppose that hundreds of years hence his own skull may be exhumed and declared to be that of a female.

One of the motives given by the author which causes so many men in the present day to deny the inferiority of woman is "a feeling for woman which inspires adoration much as religion does."

This intense tenderness and veneration for woman is God-given. He loves, and respects, and reverences her because God so planned and formed her his equal and companion. Another motive given by some, he says, to deny her inferiority is "the idea that a quantity of masculine vices are not found in woman," but adds, "She has other and greater ones of her own." True, in the garden of Eden, woman used the superior nerve spoken of by the author, and tempted Adam to sin. While Adam's inferior will power yielded to the machinations of woman, and he disobeyed the commands of God.

"The so-called higher qualities of woman do not bear a very searching analysis. Her impressionability, of which we hear much, is merely that of a child. Her hysterical and passionate outbursts when thwarted are the true equivalents of a child's screams and kicks when it is refused something it wants."

Really, we consider this the most irrational and unintelligent survey into the character and disposition of woman that could possibly be made. The writer could not possibly use such language regarding one who has assumed the title of mother. Analyze, if you please, the devotion of a mother, a Christian mother, to the child she loves and cherishes more dearly than her own life. Search and analyze, if you have the ability, the so-called higher qualities, love, fidelity, fortitude, self-denial, of your own (perhaps Christian) mother, over the same "higher qualities" of your father. These mothers who rock the cradle possess the intelligence to rule the world. "No woman can make a good cup of coffee!" The author then states the reasons. To this I make no further response than this: If she cannot, content yourself to rise early and make your own superior cup of coffee before your loved, though inferior, companion has arisen from her slumbers.

"Crime, even, demonstrates feminine inferiority, for there is generally no reflection or calculation of the probability of discovery in crimes committed by women." As statistics show a larger percentage of male criminals, his own statements argue for instead of against her; morally man must be inferior. Crime is usually a rash act, not premeditated; and the murderer who plans, and plots, and reflects, and calculates as to the results of certain deeds is usually a worse man, and morally an inferior man, to the one who commits a crime in a passion and repents the deed. We note again the author simply expresses his disbelief in the historical record of the great queens, such as Elizabeth of England, whose works he claims have been magnified. He offers nothing to substantiate his opinion. He goes on to reaffirm that woman is merely the complement of man. "As his alter ego she may be invaluable, but alone she is useless."

Here he has simply reversed God's plans. First, God made man, not woman, and he said it is not good that man should be alone. Afterward he made woman. As his alter ego she may be invaluable, but, without woman, man was found to be useless.

"The complete success of the emancipation movement would mean a struggle against the laws of nature." "What [asks Strindberg] is the cause of this unreasoning fury against man? For is it not he who after all has bestowed upon woman the benefits of culture, the right of holding property and other privileges?" The laws of nature are in the hands of God. These are not what we wish to change. It is the alterable laws of countries, made by man, we are attacking. The unreasoning fury against man spoken of is imaginary, not real. Woman still loves man, her family, her home, and seeks to protect it, but is rebellious as to her subjugation to certain laws made by man giving to him rights and privileges he is not willing she shall equally share. You say man bestows the right to woman of holding property and other privileges. The other privileges spoken of are no doubt paying the tax required by the laws without representation. "A bad feature of modern legislation is its tendency to rob the wage earner and father of the family of his daily bread in order to benefit the emancipated female, generally childless." Shame on such an assertion. You make a thorough canvass of our cities, the shops, the factories, the stores, the many places were women are employed, saying nothing of the thousands of hovels in which women are found bending over wash tubs, sewing machines, etc., and ask why they thus labor from morn till night. The larger percentage of these women will answer to support father, mother, children, or, perhaps, husband. Why? Because the fathers or husbands have neglected to properly provide for them. Again, why? Because of some of the bad features of modern legislation. While it has given to man a liberal recompense for his services, it has allowed to remain evils that drag down not only the man, but woman. Hence her desire for emancipation and equality. "Necessarily, there must be some sacrifices, and it is against these that the crowd of so-called emancipated women, who are devoid of any feeling of duty toward humanity, raise their raucous voice."

Yes, there must be sacrifices. Every mother in the universe knows that. Yet these are God-given pleasures with ample rewards. No! No! No! I am a mother and deem it a sacred duty to have children given me to teach and train, not only for time, but for eternity. And we are not devoid of duty toward humanity. For ours is a love that reaches beyond our own fireside. We are ready and willing as wives and mothers to rock the cradle. But the day has come when woman can no longer be kept beneath her equal. Through education are we enlightened. Possibly France has not yet arrived at the place where she is ready to accept or concede woman the equal of man. But America, the republic of the world, is saying in many of her States, and the echo is sounding through her national capitol:

"Woman! Woman! God bless her noble nature and generous spirit." And as the echo rolls from State to State all over America, we hear again and again the repetition sounding in senate chamber and legislative hall, "Welcome, noble woman."

MRS. DR. A. S. RUDY.

734 South Main Street, Lima, O.

Platinum.

The Ural platinum deposits in Russia are the only ones in the world, as this metal is worked nowhere else, and is known simply as a mineral finely disseminated in certain rocks. Platinum occurs in the Ural government of Perm, where it is found on various private properties and state lands. In the district of Goroblagodat there are 70 allotments for the exploitation of platinum under different private individuals. The metal is found in the form of alluvial deposits or platinum-bearing sands, which frequently also contain gold. These deposits vary in thickness; they are rarely less than three and often reach seven feet; the grains are usually small in size, but occasionally small nuggets are found weighing one or more kilogrammes. The platinum is frequently accompanied by other rare metals, such as iridium and osmium. At present all the platinum extracted in the Urals is forwarded in the crude state to St. Petersburg, whence it is sent abroad. Although there are two laboratories in the Russian capital for refining platinum ore, the greater quantity is sent abroad in the crude state. The production is subject to a tax of 3 per cent for leasehold and 4 per cent for freehold works. The rapid and variable fluctuations in the price of a product having no definitely fixed exchange value, but indispensable to the arts, reflect upon the production of platinum in Russia. Thus, when the price of the metal is high, it becomes profitable to work the poorer deposits, while it is only possible to work the very richest when the price is low. Although the first platinum deposits in Russia were discovered so far back as 1819, the actual exploitation of this metal began only in 1824, when rich veins were discovered in the Nizhni-Tagilsk district. From 1828 to 1845 platinum money was coined in Russia. The denomination of these coins was three, six and twelve rubles; the total value of platinum money put into circulation was 4,250,000 rubles. During this period the production of platinum increased considerably, but when platinum coinage ceased the exploitation of the metal was almost entirely stopped, and only revived in 1859. In 1887 the production of pure platinum was 269 poods 4 pounds, in 1890 it was 173 poods 26¾ pounds. The value of the yearly export of platinum, which goes chiefly to England, is about 1,560,000 rubles. The largest quantity of platinum is now extracted at the deposits of Nizhni-Tagilsk, belonging to Prince Demidoff San Donato, and at the Krestovosdvigensk deposits of Count Schouvaloff. In 1890 there were 6,000 workmen employed in the exploitation of platinum.—Petersen's Trade Review.

The New Mauser Repeating Rifle.

The new Mauser repeating rifle was exhibited at Fort McHenry, Maryland, on April 1, by Captain Marksclaeger, of the steamship La Campine. The new gun is one of the first made for the German government. It is something like the Krag-Jorgensen military rifle which is now being adopted in the United States Army. It is of 32 caliber and the construction is on the same principle as the Krupp gun, the barrel being of three tubes, one inside the other. The inner tube is made of hard tempered steel and is rifled. The bullet is propelled by a smokeless powder. Fired at the height of the shoulder, the bullet, it is said, will go nearly two miles before becoming spent, and at 2,000 yards it will pierce the bodies of seven men placed one behind the other.

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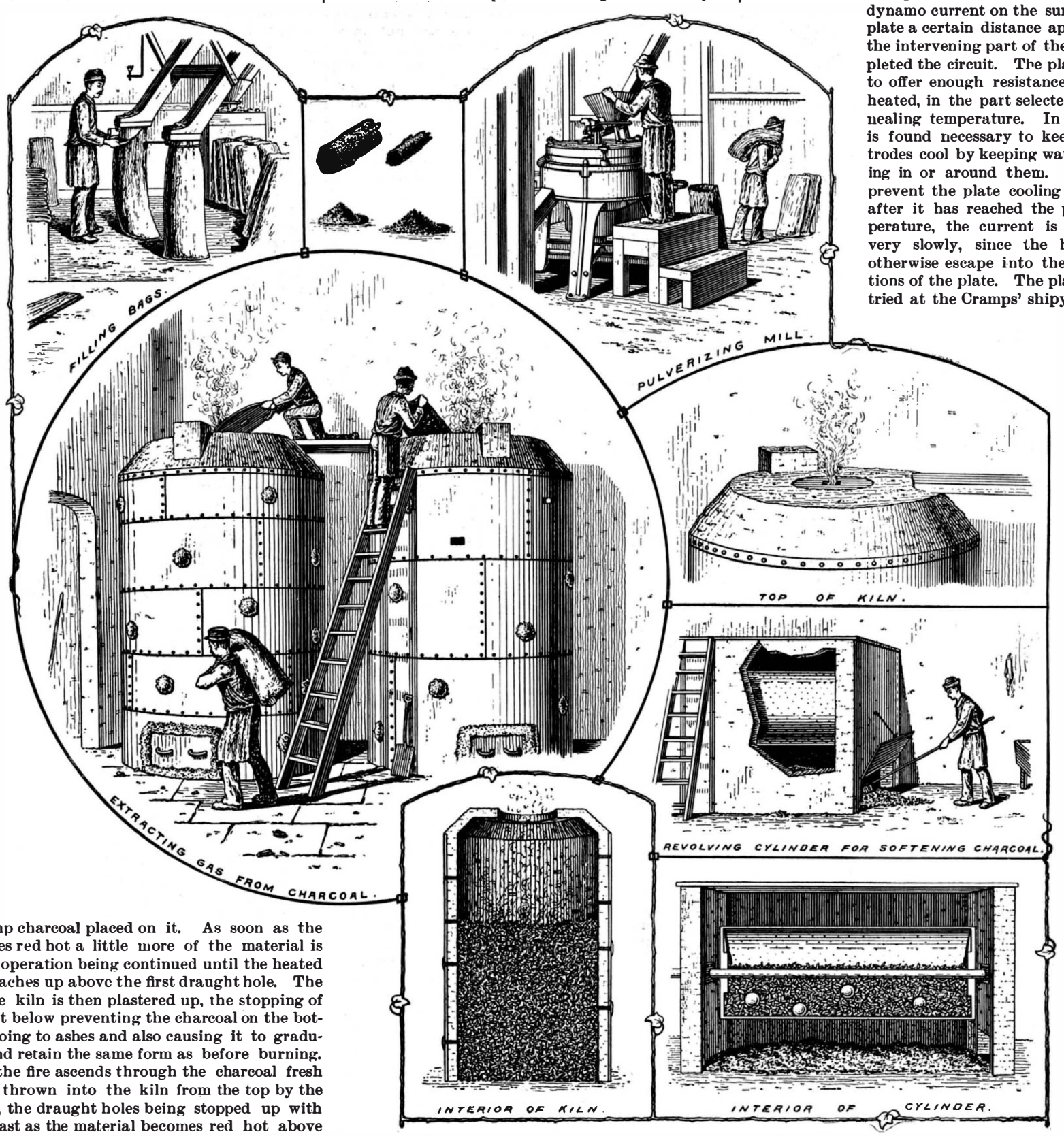
THE PULVERIZED CHARCOAL INDUSTRY.

Pulverized charcoal is used principally for purifying water, wines, glycerine, etc., and also used for packing purposes. The lump charcoal used here comes principally from Delaware and New York State. The material is bought by the carload by the manufacturer, who first extracts the gas from the coal by reburning it in kilns, after which the material is passed through a cracking, softening and grinding process which produces any grade of charcoal, ranging from flour to pieces as large as peas. The kilns are made of ⅛ inch boiler plate iron. They are about 10 feet in height, about 6½ feet in diameter inside and lined on the interior with fire brick. Each kiln is pierced with about 18 draught holes about 4 inches in length and about 3 inches in height. A wood fire is first started in the bottom of a kiln and about two or three barrels or bags of lump charcoal placed on it. As soon as the coal becomes red hot a little more of the material is added, the operation being continued until the heated charcoal reaches up above the first draught hole. The door of the kiln is then plastered up, the stopping of the draught below preventing the charcoal on the bottom from going to ashes and also causing it to gradually cool and retain the same form as before burning. As fast as the fire ascends through the charcoal fresh layers are thrown into the kiln from the top by the attendants, the draught holes being stopped up with plaster as fast as the material becomes red hot above each opening. The kiln holds about 70 barrels of charcoal. The top of the kiln is bricked over with the exception of a circular opening about 2½ feet in diameter in the center.

After burning for about 12 hours a circular piece of sheet iron is placed over the opening, which smothers the fire, the gas escaping by means of a small hole in the center of the plate. The gas is extracted from the coal to prevent the material passing through it from tasting gassy. It requires about 5 hours to fill a kiln and about 48 hours after the fire has been started before the material is sufficiently cooled so that it can be handled. The kilns are emptied from the bottom, the attendants shoveling out the charcoal, which is put into bags and carried off to a cracking machine to be broken up into small pieces to prevent the choking up of the pulverizing mill. A kiln is emptied in about 1½ hours. From the cracker the charcoal passes to an elevator, where it is carried by means of cupped belts to a pulverizing machine, where the material passes between two circular stones, similar to a miller's grindstone, one of which revolves at the rate of 70 to 75 revolutions per minute, grinding the material up into any grade. From the pulverizing mill the charcoal is carried by elevator to a revolving screen or sieve. The screens are about 4 feet in length, hexagon shaped and about 2 feet in diameter, the wire cloth from which the screen is made ranging from 3 to 24 meshes to the inch. From the screen the material passes down through wooden chutes, where it is packed into 78 lb. bags for the market. The tailings or coarse material not properly ground is taken back and run through the pulverizing mill again. The apparatus for softening charcoal for hard packing are hollow circular iron cylinders about 8 feet in length and about 4 feet in diameter. They revolve in the interior of inclosed brick compartments, two cylinders in each geared together.

These compartments are about 9 feet square, about 8 feet in height, and about 1 foot in thickness, and are covered over at the top with an iron plate. The cylinders are perforated with holes about ⅛ of an inch in diameter, and about 6 inches apart, through which the material drops when ground to the floor below. The cylinders are filled from the top about every two hours, the material being ground to a powder as the apparatus revolves, by means of 8 to 10 lb. cannon balls in each, weighing from 10 to 12 lb. each. The cylinders revolve at the rate of about 60 revolutions per minute, the rolling of the balls through the charcoal causing the material to soften. About every six weeks the hard, unbroken chunks that the iron balls will not break are dumped out of the cylinders and burned in the furnace. If the cylinders revolve too quickly, the balls pound the material and turn it out gritty. The ground charcoal is scraped from the floor of the compartments with hoes, the attendants carrying it to the elevators, where it is conveyed to the screens and down through the chutes to the bags below. Our sketches were taken from the plant of Merrill & Wehrle, New York, who turn out, with 25 men, about 14 bags of pulverized charcoal per hour, weighing about 78 lb. each.



THE PULVERIZED CHARCOAL INDUSTRY.

Boring Holes in Hardened Armor Plate.

The success attained of late in hardening the surface of armor plate has made it necessary to devise some especially effective method of boring holes in the plate for the bolts which are to hold it in position. A number of experiments have been made with the idea of softening a spot on a Harveyized plate large enough to allow a drill to pass through, but without weakening the plate itself. The oxy-hydrogen blowpipe has been used for this purpose, but without success. No method has been found entirely satisfactory until the attempt was made recently to soften a spot by employing an electric current. The successful method consisted in placing the two electrodes of a dynamo current on the surface of the plate a certain distance apart, so that the intervening part of the plate completed the circuit. The plate is found to offer enough resistance to become heated, in the part selected, to an annealing temperature. In practice it is found necessary to keep the electrodes cool by keeping water circulating in or around them. In order to prevent the plate cooling too rapidly after it has reached the proper temperature, the current is diminished very slowly, since the heat might otherwise escape into the other portions of the plate. The plan has been tried at the Cramps' shipyard on the barbette plates of the Massachusetts, and the results are said to be very satisfactory.

Activity in Railway Building.

A very gratifying revival of activity in railway building throughout the United States is announced by the Railway Age. According to the table prepared by this publication, some 20,547 miles of new road are now either in course of construction or are about to be built in the near future. The 20,547 miles of new track comprises many new short lines and extensions on old roads in forty-six States and Territories. The State of Texas, with a proposed new mileage of 2,913 miles, takes the lead, California ranks second with 1,390 miles of new track, Arkansas with 1,377, Pennsylvania 768, New York 393 miles, etc. During the year 1894 less than 2,000 miles of track were laid in the United States. It is stated that the construction of the 20,547 miles of proposed railway is assured by trustworthy financial backing.

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A VISIT TO THE EXHIBIT OF THE NEW YORK ACADEMY OF SCIENCES.

BY PROFESSOR H. F. OSBORN.

The annual reception and exhibit of recent progress in science was instituted last year by the New York Academy, upon the model of the famous "conversazione" of the Royal Society of London. These social scientific meetings of the Royal Society, which are held on two or three evenings in the course of the winter, bring together savants from all parts of Great Britain. There are usually from forty to fifty exhibits, partly of a popular character, but mainly illustrating the most recent discoveries in England or the Continent. The distinctive feature of each discovery is set forth with great clearness, either by personal explanations given by the exhibitor himself or by some diagramatic method. Englishmen have a gift of exposition of scientific truth which is exemplified in a remarkable degree both by the writings and teaching methods of such men as Huxley and Tyndall.

From a study of the catalogue of this second exhibition of the New York Academy it is apparent that we have much to learn from the Englishmen in this respect, and that one result which these exhibitions should bring about is an improvement in the methods of extending scientific truths to wider circles. The exhibit of the Academy as a comparatively local society naturally presents a contrast in being of a less national character, and yet one cannot fail to be struck by the broad fields of research now being entered by the scientists of this city, with the promise of some really great results in the future.

Of five hundred exhibits displayed, it is only possible to mention a few. All of our educational institutions contribute, while a number of the most important objects come from great distances, such as the photographs from the Allegheny and Lick Observatories to be shown in the astronomical section. This section is in charge of Mr. Charles A. Post of the Strandhome Observatory, and among the ten exhibits he has brought together are photographs of star spectra between F and D shown by Professor Keeler of the Allegheny Observatory. This is the portion of the spectrum most easily observed by the eye, and these plates are referred to as evidence that photography is superior to the eye even on its own ground. Professor Barnard of the Lick Observatory exhibits valuable glass negatives of comets and the Milky Way made with the new six inch Willard portrait lens, refigured by Brashear. There are also other series of photographs from the Lick and Strandhome Observatories. In the mechanical section Professor Woodward exhibits models of the international prototype meters and kilogrammes, which have been lately adopted as the standard of length and mass respectively by nearly all nations. One of the most novel exhibits in physics is a series of "Chladni" figures shown by Professor Alfred M. Mayer of Stevens Institute, who has charge of this section. The figures are formed in white sand upon vibrating metallic plates, and Professor Mayer's process consists in fixing the sand upon a black background after the figures have been formed, by means of a fixative spray. These plates demonstrate the truth of Lord Rayleigh's theoretical deductions, and differ radically from all figures which are shown in modern text books in the fact that none of the lines intersect. The physical exhibit is an extensive one, including a large number of instruments for spectroscopic as well as for sound and light measurements, mainly devised by different members of the Columbia Physical Laboratory. The mineralogical exhibit has been arranged by Dr. L. P. Gratacap of the American Museum of Natural History, and includes about one hundred objects, the most notable being a series of Babylonian and Assyrian cylinders and seals arranged to illustrate the different mineralogical materials used for these purposes between 4,000 and 300 B. C. This is from the collections of Tiffany & Co. and of the Rev. W. A. Ward. The American Museum of Natural History contributes an attractive series in the line of zoology under the direction of Professor J. A. Allen. The rapid improvement in methods of taxidermy is illustrated by a series of comparisons between the work just completed at the museum and that of ten years ago. The most striking of these pairs is that of two chimpanzees, the modern example being the late Chico, so well known in New York, which has just been mounted by Mr. J. Rowley, Jr. Two wild turkeys mounted side by side show in the modeling of the head and wattles the greater naturalness of recent work. Adjoining this exhibit is that made in different lines of research by Columbia biologists. First is a series of preparations of nerve cells from the brain and spinal cord, illustrating the great advance in our knowledge of the nervous mechanism which has been made by the method discovered by Professor Golgi of Pavia. By a silver nitrate impregnation we secure a picture of the nerve cell with its finest processes standing out like a silhouette on a light background, a technical result which has worked a complete revolution in all our ideas regarding the relations of the nervous system. The exhibitor, Mr. O. S. Strong, shows two of his own improvements upon the original Golgi method.

A second series is that made by Messrs. Wilson, Calkins and Kean, showing the relations of the archoplasm and chromatin, the two substances which lie at the basis of all the phenomena of inheritance both in animals and plants.

These elements are seen in several different types of animals, the most novel series being that shown by Professor Wilson, which is the basis of a discovery of great significance, namely, that the paternal cell alone contributes the dynamic or cell-dividing substance to the new individual, from which we infer that the chromatin alone, as a product of both sexes, is the bearer of hereditary qualities, for it is evident from Galton's researches that such qualities are equally contributed by both parents. These so-called fertilization phenomena are beautifully shown on a large scale to those not familiar with high powers of the microscope by a series of micro-photographs taken by Dr. Edward F. Leaming, who has charge of the entire photographic section. In this section we find some striking examples of the latest stages of perfection in pictures taken through the microscope, shown in connection with nerve preparations and also in photographs of bacteria. There is also here a large exhibit of the latest photographic apparatus, to which one of the side rooms of the galleries is devoted.

In operation during the evening is a triple lantern, designed by Mr. Frederic Ives, of Philadelphia, showing

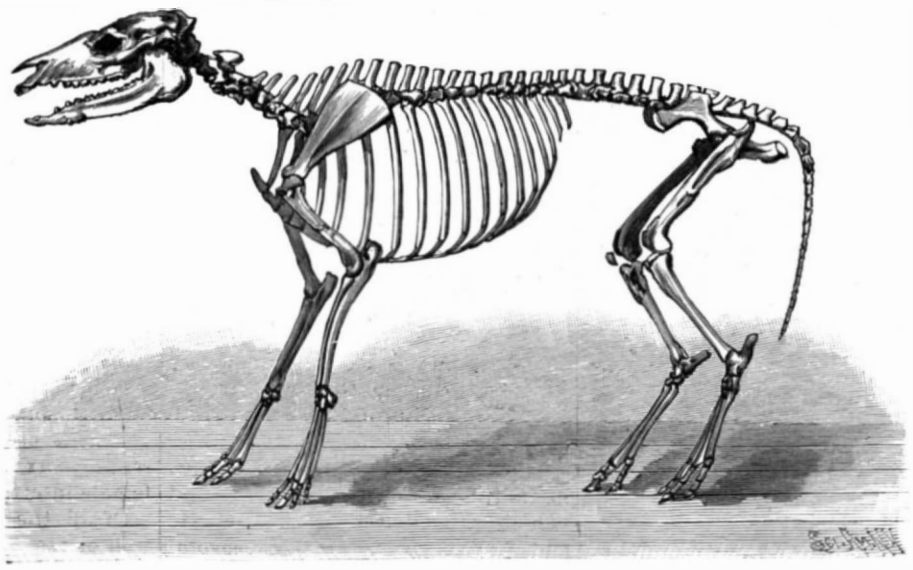

Fig. 1.—PRIMITIVE HORSE—HEIGHT, THREE AND ONE-HALF HANDS.

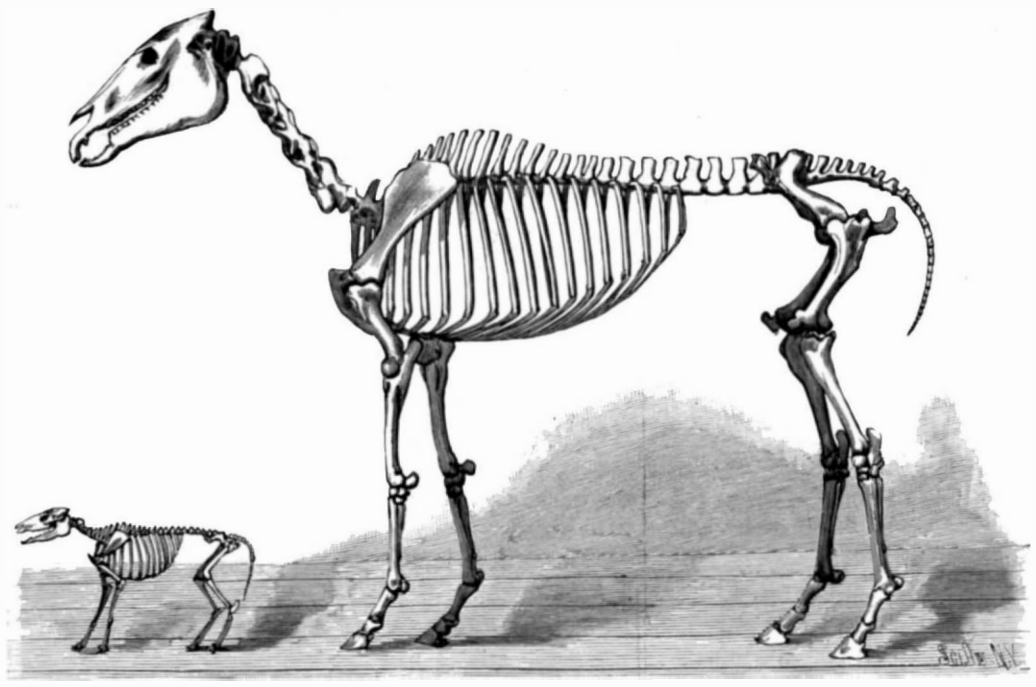

Fig. 2.—COMPARISON OF PRIMITIVE HORSE AND MODERN TROTTER.

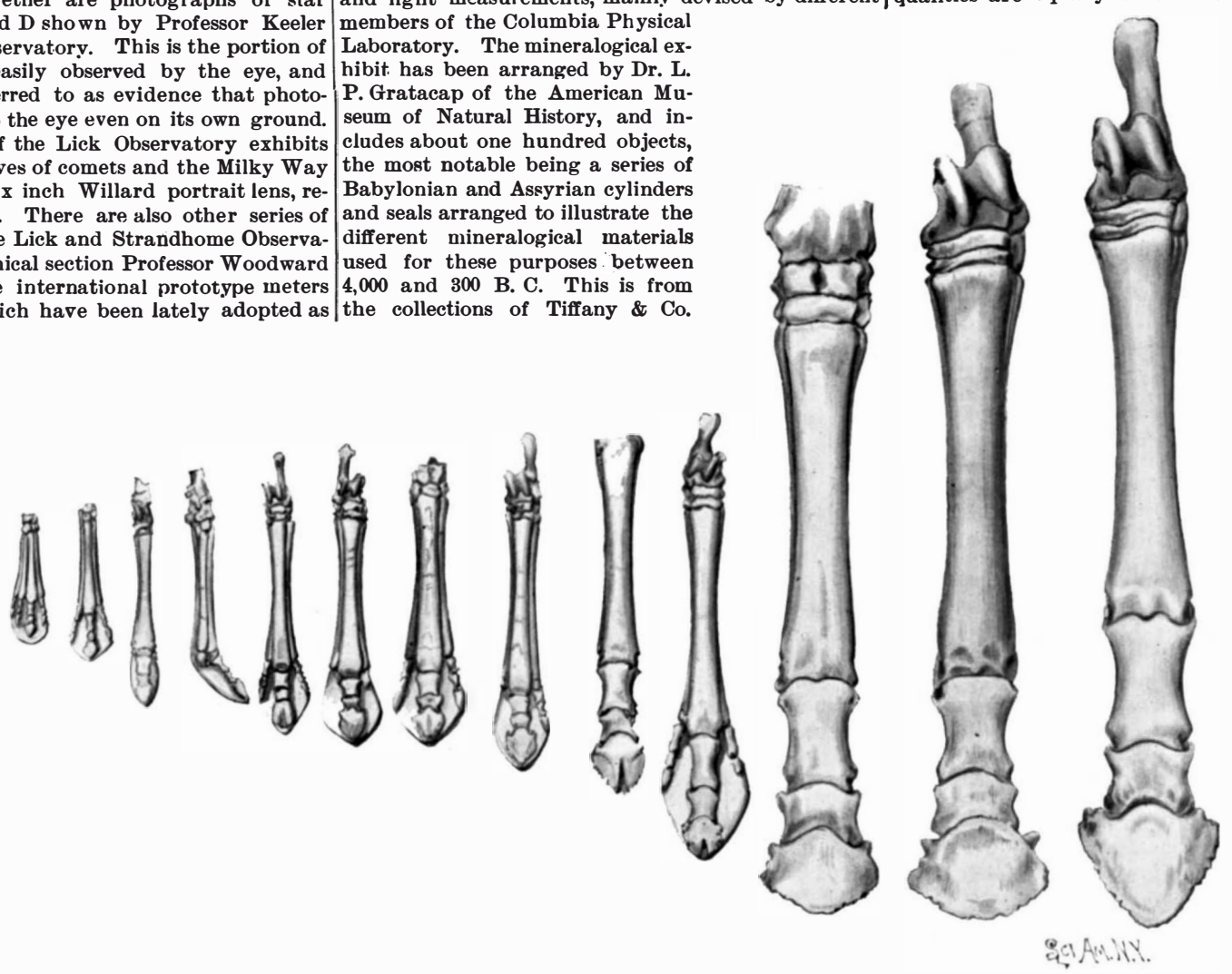

Fig. 3.—EVOLUTION OF THE HORSE AS SHOWN BY THE FOOT.

On the left is the fore foot of the ancestral four-toed horse, found in the Eocene beds of the Wasatch Mountains, Northern Wyoming. Passing to the right are the intermediate stages of evolution, represented in fore and hind feet found in Dakota, Nebraska, and Texas, terminating with the modern horse upon the extreme right.

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the projection of the three primary colors in lantern slides so combined as to produce the effect on the screen of a picture in natural colors. All the recent advances in half tone and color printing are also shown.

In an adjoining room is the bacterial exhibit arranged by Dr. T. M. Cheeseman, of the College of Physicians and Surgeons, whose recent exposé of the impurities of the Croton water supply is familiar to New Yorkers. A very large number of pathogenic species are shown, the new feature in each case being that all the types have been preserved by the new formalin method. The recent discovery of the cure for diphtheria is illustrated by the specific germ of this disease, also by vials containing the "toxin" which is used to inoculate horses and other animals to induce immunity, and by the "anti-toxin" drawn from the serum of the blood of the horse. Professor John G. Curtis has charge of the physiological department in which many new forms of apparatus for experimental investigation are shown. The exhibit of experimental psychology arranged by Dr. Farrand is of a similar character. Geology and paleontology are in the care of Professor Kemp and Professor Osborn respectively. Here is a large collection of the evidences of the series of great volcanoes which extended along the Atlantic seaboard from New Brunswick to North Carolina during pre-Cambrian times. These eruptive rocks have been found to possess in greater or less perfection all the characteristic structures of recent lavas. The discovery and proof of the existence of these volcanoes is one of the most surprising results of recent geology work in this country. Various types of invertebrate fossils show the work which has been done in the ancient life of the Atlantic coast. The most striking is the rich collection made by Messrs. Van Ingen and Matthew at St. John, N. B., demonstrating the existence of a varied fauna in the middle and lower Cambrian, which has hitherto been considered extremely barren. In vertebrate paleontology the main exhibit is that showing the evolution of the horse, as here illustrated. The wonderful series connecting the oldest known horse of the lower Eocene period with the modern horse is probably the most complete which has ever been brought together. The American Museum of Natural History has recently acquired the famous little four-toed horse from the collection of Professor Cope, of Philadelphia, and it is here publicly exhibited for the first time (Fig. 1). This little animal, although fully matured, is only 3½ hands high, and is estimated at two million years of age. The skull and limbs, nevertheless, display the most undoubted characteristics of the horse, there being a broad space in the lower jaw corresponding to the space for the bit. The teeth are short and simple; the limbs are scarcely larger in diameter than a good sized pencil, and there are four toes, all resting upon the ground, in the fore foot. To those who still doubt whether this little animal is actually the ancestor of the modern horse, a remarkable series of feet is exhibited (Fig. 3), giving all the stages between this four-toed and the modern one-toed animal, in which the median toe is seen constantly increasing in size, and the side toes are constantly diminishing until they are reduced to the pair of splints. This evidence is further confirmed by an almost equally complete series of skulls showing every stage in this wonderful development. The two extremes of this remarkable series are shown in the little four-toed animal placed beneath the head of the modern trotting horse skeleton (Fig. 2), showing the exact relative size of each. This exhibit, together with botany and anatomy, is placed in the Vanderbilt gallery. Dr. Curtis, of Columbia, has charge of an extensive display from the botanical laboratories of Columbia and of Barnard, including the collections made by Messrs. Small and Nash in Georgia and Florida and the microscopic studies of Dr. Schneider upon the North American lichens. In anatomy, Professor Huntington has arranged a complete series, showing the comparative anatomy of the ileo-cæcum.

It is already informally decided to make this reception an annual affair. The galleries prove to be perfectly adapted to the purpose, with admirable wall space for charts and diagrams, very extensive floor and table space, and every facility for general and special electrical illumination.

Natural History Notes.

The Eozoon.—Eozoon was a name applied to a supposed genus of animals, because when first examined by Dr. Dawson, of Montreal (1864), it was the oldest fossil then known to exist, and its appearance was held to be, as the name denotes, the dawn of life upon the globe. Some naturalists have believed it not organic, while others, such as Dr. William Carpenter and Prof. T. Rupert Jones, have considered it a rhizopod or a foraminifer. It occurs in the Laurentian of Canada, and is called Eozoon Canadense.

Messrs. Johnston Lavis and J. W. Gregory, in a memoir recently published in the Transactions of the Royal Society of Dublin, finish the history of this supposed fossil animal. Doubts were expressed as long ago as 1865 as to the organic nature of this object, and the conclusions of Moebius upon the subject have now been fully confirmed by the English investigators above mentioned, who have not been able to find in the specimens of Eozoon examined by them anything but traces of mechanical and chemical alterations of the rock. It is very interesting to note that the vestiges of the pretended "dawn of life" are particularly abundant in the rocks thrown out by Monte Somma, and the authors conclude that the Eozoon is due to an alteration of calcareous rocks inclosed in an igneous magma in fusion, in fact, to a true metamorphosis.

Varieties of Chlorophyl.—Mr. Etard has previously shown that the green coloring matter of phanerogamous plants consists of a mixture of pigments, and he now points out (Comptes Rendus, cxx., 328) that chlorophyl may be more or less blue, green or yellow, according to the plants from which it is obtained and the treatment to which it has been subjected. He finds that lucerne (Medicago sativa) contains several distinct chlorophyls, among others α-medicagophyl and β-medicagophyl. Certain chlorophyls, soluble in pentane, are, by their decomposition in the plant cells, the cause of the formation of essences and oils by chemical means. Others again, which are not so soluble, mix with water. These are very rich in oxygen and become decomposed to produce carbo-hydrates, tannins, etc.

Sight in Insects.—Dr. C. V. Riley, in his recent address as president of the Biological Society of Washington, said: Of the five ordinary senses recognized in ourselves and most higher animals, insects have, beyond all doubt, the sense of sight, and there can be as little question that they possess the sense of touch, taste, smell and hearing. Yet, save, perhaps, that of touch, none of these senses, as possessed by insects, can be strictly compared with our own, while there is the best of evidence that insects possess other senses that we do not, and that they have sense organs with which we have none to compare.

Taking the sense of sight, much has been written as to the picture that the compound eye of insects produces upon the brain or upon the nerve centers. Most insects that undergo complete metamorphoses possess, in their adolescent states, simple eyes or ocelli, and sometimes groups of them of varying size and in varying situations.

It is difficult, if not impossible, to demonstrate experimentally their efficiency as organs of sight; the probabilities are that they give but the faintest impressions, but otherwise act as do our own. The fact that they are possessed only by larvæ which are exposed more or less fully to the light, while those larvæ which are endophytous, or otherwise hidden from light, generally lack them, is in itself proof that they perform the ordinary functions of sight, however low in degree. In the imago state the great majority of insects have their simple eyes in addition to the compound eyes. In many cases, however, the former are more or less covered with vestiture, which is another evidence that their function is of a low order, and lends weight to the view that they are useful chiefly for near vision and in dark places. The compound eyes are prominent and adjustable in proportion as they are of service to the species.

It is obvious from the structure of these compound eyes that impressions through them must be very different from those received through our own, and, in point of fact, the late experimental researches of Hickson, Plateau, Tocke and Lemnermann, Pankrath, Exner and Viallanes, practically established the fact that while insects are shortsighted and perceive stationary objects imperfectly, yet their compound eyes are better fitted than the vertebrate eye for apprehending objects set in relief or in motion, and are likewise keenly sensitive to color.

So far as experiments have gone, they show that insects have a keen color sense, though here again their sensations of color are different from those produced upon us. Thus, as Lubbock has shown, ants are very sensitive to the ultra-violet rays of the spectrum, which we cannot perceive, though he was led to conclude that to the ant the general aspect of nature is presented in an aspect very different from that in which it appears to us. In reference to bees, the experiments of the same author prove clearly that they have this sense of color highly developed, as indeed might be expected when we consider the part they have played in the development of flowers. While these experiments seem to show that blue is the bee's favorite color, this does not accord with Albert Muller's experience in nature, nor with the general experience of apiarians, who, if asked, would very generally agree that bees show a preference for white flowers.

Economic Uses of Insects.—Lowly as they seem in point of organization, there are few animals that exceed insects in commercial importance. The finest red dyes known to manufacturers before the introduction of coal oil colors were derived from insects. The Leucanium Ilicis, an inhabitant of the evergreen oak, was employed for this purpose by the ancient Greeks and Romans, as it is still by the Arabs; and, until the introduction of the Mexican cochineal, another species, the Coccus Polonicus, living on the roots of the Scleranthus annuus in Central Europe, was much used for the same purpose. The Mexican cochineal, which drove all other kinds out of market, is one of the species of Coccinia. This insect was long regarded as a parasite upon the prickly pear. For many years the cultivation, or rather feeding, of the cochineal insect was entirely confined to Mexico, but it has now been introduced into Spain and the French possessions of Africa. A fourth species of great importance is the lac insect, Coccus lacoa, an inhabitant of the East Indies, where it feeds upon the banyan and other trees. It is to this insect that we are indebted, not only for the dye stuffs known as lac dye and lac lake, but also for the well-known substance called shellac, so much used in the preparation of varnishes and sealing wax. It is somewhat remarkable that only the female insects yield a good coloring matter.

Of all the secretions peculiar to insects, silk may well be regarded as the most valuable, since it has become as much an essential to the purposes of mankind as to the economy of its producers. The fluid, before it comes in contact with the air, is viscous and transparent in the young larva, but thick and opaque in the more mature. By chemical analysis, it is found to be chiefly composed of bombic acid, a gummy matter, a substance resembling wax, and a little coloring matter. Silk may be placed in boiling water without undergoing any change, the strongest acids are required to dissolve it, and it is only quite recently that it has been imitated artificially.

Then we have large sums of money changing hands from the labors of the useful little bee, tons of weight of honey and beeswax being yearly consumed.

The Spanish fly is an indispensable article in the treatment of certain forms of disease, and that invaluable agent, chloroform, was first made from formic acid, an acid discovered in the formic ant and from which it has derived its name. Then there are nutgalls, produced by a small fly, and for which a substitute could not be found in dyeing and ink making.

Diastatic Ferment in Plants.—From experiments on seedlings of Canna, Platanus, Phaseolus, etc., Dr. J. Gruss concludes the existence in seedlings of a soluble diastase which is capable of diffusion through the cell wall in the same way as sugar. It appears to pass, with maltose, out of the cotyledons into the stem; for the removal of the cotyledons diminishes the amount of diastase in the stem. The quantity of diastase present was ascertained by its action on starch, the iodine test being used to determine the extent to which the starch had been destroyed. The penetration of the diastase into the substance acted on is accompanied with a simultaneous change in the latter, and to this process the author applies the term "allenolysis." The action of the diatase on the reserve cellulose in the seed of the date is very slow, and ends in its transformation into soluble products, probably mannose. It is by this action of diastase that the absorption of reserve cellulose takes place in the germinating date.

Vitality of Seeds.—Dr. Peters, of the Botanic Garden of Gottingen, has been experimenting with seeds taken from different depths of soil in a dense wood from 100 to 150 years old, which had been arable land for many years before it became woodland. His object was to discover how long the seeds of weeds would retain the power of germinating after they had been buried in the soil to a depth where they could not sprout. Soil samples were taken at various distances from the surface to the depth of a foot. These samples were placed under genial conditions and the seeds which germinated were raised and cultivated to a flowering stage. Although the land had ceased to be arable between 300 and 400 years before, the weeds of cultivation were abundantly represented, and Dr. Peters claims to have proved that the seeds of many field and pasture plants retain their vitality considerably more than half a century.

The Flight of Birds.—Hawks, says Fleming, in his Philosophy of Zoology, probably fly at the rate of 150 miles an hour, and an eider duck at 90 miles. Sir George Cayley estimates that the common crow flies at nearly 25 miles an hour. Spallanzani found the rate of the swallow to be 92 miles an hour; while he conjectures the velocity of the swift to be nearly three times greater. A falcon that belonged to Henri IV, of France, escaped fron Fontainebleau, and in twenty-four hours afterward was found at Malta, a distance of not less than 1,530 miles; a velocity equal to nearly 57 miles an hour, supposing the bird to have been unceasingly on the wing. But, since such birds never fly by night, and allowing the day to be at the longest, its flight was, perhaps, equal to 75 miles an hour. If we even restrict the migratory flight of birds to 50 miles an hour, how easily can they perform their most extensive migrations. Fair winds may perhaps aid them at the rate of 30 or 40 miles an hour, or even help them attain three times greater rapidity.

Two sections of the great Russian railway across Siberia are now in operation. The aggregate of the two is 761 miles. The total length of the road is to be 4,000 miles.

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Loss of a Spanish War Ship.

The sad intelligence is announced of the foundering at sea of the splendid armored cruiser of the Spanish navy, the Reina Regente, with loss of some 420 officers and crew. On the 10th of March the ship sailed from Tangier for Cadiz, and sank, it is believed, the following day during the prevalence of a great storm. The tips of her topmasts were found projecting from the water near Gibraltar and the Spanish coast.

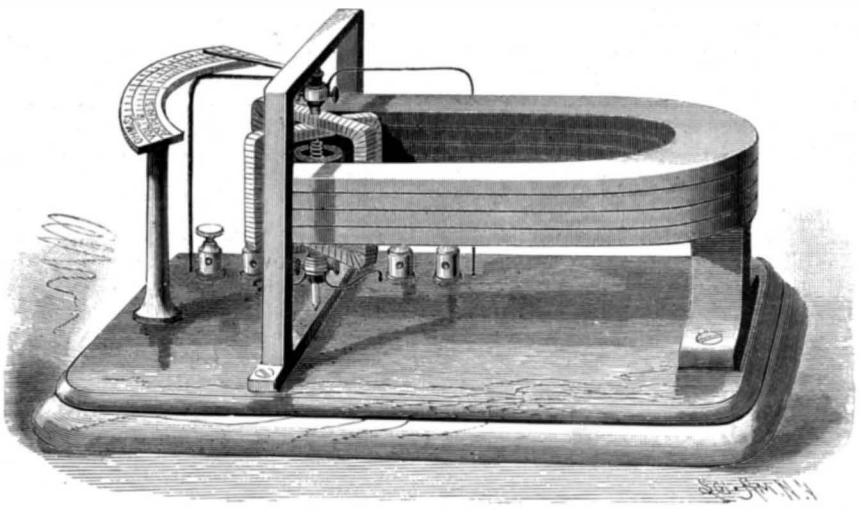
The Reina Regente was built and engined by Messrs. James & George Thomson, of Clydebank, for the Spanish government. The following were her measurements: Length over all, 330 feet, and 307 feet between perpendiculars; breadth, 50½ feet; and her draught was 20 feet; displacement, 5,600 tons when fully equipped.

There was a very minute subdivision in the hull of the ship, there being, in all, 156 water-tight compartments, 83 of which are between the armored deck and the one immediately above it, or between wind and water. Most of these compartments were used as coal bunkers, and appear to have been of no avail in preventing the fatal catastrophe.

The Reina Regente was one of the ships which took part in the grand naval parade in New York harbor in 1893, when she attracted much attention from her graceful lines and formidable appearance.

A COMBINATION ELECTRICAL METER.

The meter shown in the illustration is adapted to measure and indicate with nicety the ohms, volts, amperes, or watts, in measuring an electric current. It has been patented by Mr. Herschel C. Parker, of No. 21 Fort Greene Place, Brooklyn, N. Y. Supported on a suitable base is a permanent magnet, between the poles of which, on a common axis, turn coils wound respectively for high and low resistance, the coils as they turn moving a hand over a segmental graduation indicating ohms, volts, and amperes, and which may be marked to indicate watts. The coils and magnets may, if desired, be differently arranged, but as shown the inner coil is wound for low resistance and the outer one for high resistance, both coils being secured to upper and lower axles on which are insulating collars with binding posts. Two of the binding posts are connected by light flexible wires with the low resistance coil, and by other wires with binding posts on the base, while two other binding posts on the axles are connected with the high resistance coil and with other binding posts on the base, the posts on the base being adapted for connection with the current wires to be measured. The coils turn against the tension of a light spring secured to the coils and to a bracket which supports a core centrally within the coils. The top axle carries the indicating hand, and the current may be brought to the coils, if desired, through the torsion spring. In use as an ohm meter the high resistance coil is joined in parallel with the resistance to be measured, and the low resistance coil is joined in series, the action then being proportional to the ratio of the potential difference to the current, or from Ohm's law, $R=E\div C$. By giving the coils the proper resistance the deflection will be proportional to the ohms in the circuit, the ohms being indicated by the indicator hand on the segmental graduation. For use as an ammeter, the low resistance coil is employed, and for a volt meter the high resistance coil, and the coils are arranged parallel instead of at an angle to each other for use as a watt meter.



PARKER'S ELECTRICAL METER.

The Rubies of Burma.

At a recent meeting of the Royal Society a paper by Mr. C. Barrington Brown and Professor J. W. Judd, F.R.S., was read on "The Rubies of Burma and Associated Minerals: their Mode of Occurrence, Origin, and Metamorphoses." The ruby district of Upper Burma, it was stated, so far as explored, is about 26 miles long and 12 broad, and lies at elevations varying from 4,000 feet to 5,500 feet above the sea level. The principal mining center in this district is Mogok, and the present workings for rubies extend over an area of 45 square miles, old workings, however, being found over an area of 66 square miles. It is also probable that ruby-bearing limestones and the alluvial earths derived from them may be found in portions of the Shan states. It is in the lower clay beds of the river alluvia, and in similar deposits formed in gullies in the hill wash, that the rubies, spinels, and other gems of the district are found. Operations for the obtaining of rubies are carried on in Burma in four different ways. In the alluvia, square pits from 2 feet to 9 feet across, ingeniously timbered with bamboo, are sunk to the ruby earth, the drainage of the pits and the removal of material being effected by baskets attached to balance poles, both made of bamboo. In the hill wash long open trenches are carried from the sides of a gulley. Regular mines are opened in some places, while the limestones are at one or two points quarried.

Speed of Typewriters.

The speed of typewriters is a vexed and much discussed question. A few years ago manufacturers used to get up contests to test the speed of the various machines. The competition grew very keen, and the number of words written in a minute became so high (about 150) that a record was established. Then as the unsuccessful machines were hurt more than the successful ones were benefited, the race was dropped, as the game was not worth the candle. As a matter of fact, the only thing settled by such contests was which concern could produce the most expert operator. The races were contests of skill among the operators, and had little, if anything, to do with the actual merit of the machines. Indeed, the only material difference between the leading machines as regards speed is the size of the keyboard or number of keys operated. Some have more than seventy, or as many keys as there are characters, while others have less than forty, each key actuating several characters that are brought into alignment by shifting mechanism. Naturally, both systems have their adherents, but, owing to the inability of either side to prove any superiority, it may fairly be concluded that no advantage exists.

A truer test than the contests referred to is to set the several machines on a lathe, and construct a cylinder or barrel similar to that of a music box, which shall depress the several keys required to produce words and sentences, and in that way reach the actual limit to which each would respond by increasing the speed of rotations of the barrel. This has actually been done, and the result was so far ahead of what is possible for human capacity to perform with the fingers, that there seems no doubt that even the poorest typewriter will respond far beyond the capabilities of any operator.

Since every machine is capable of more rapidity than the human operator can get out of it, the next point to be considered is the speed an expert operator can keep up for a short space of time. As stated, the limit so far reached is in the neighborhood of 150 words a minute, but it must be understood that this record was made by writing a sentence which had been long practiced. The reason for picking out a particular sentence and practicing it is very simple. The use of letters whose keys are close together, and convenient for alternate action of the hands, greatly assists the speed, and the more a particular sentence is practiced, the more rapidly can it be typewritten. Take the very operator who has shown a speed of, say, 150 words, and get him to write a sentence composed of the same letters, but made up of different words, so that the letters are in a different order, and the speed will fall very materially. The loss may be, perhaps, one-third. It is possible for a comparative novice to practice a well selected sentence and in a short time reach about the same speed as the expert, but in the case of the novice the speed would fall tremendously on new matter. The strain on the eyes and mind increases with the speed, until a point is reached where it cannot be kept up for any length of time, and it is worthy of note that some operators have had the keys blank, without any characters marked, in order to relieve the strain on the eyes.

In considering the speed of the average operator, considerable difficulty is experienced in arriving at any accurate conclusion, owing to the tendency of all operators to put on extra steam when timed or watched. By far the greater part of the work done on typewriters is copying, either from stenographic notes or other manuscript, and a fair average would be below forty words a minute.

There is, of course, some time lost in reading from the copy, when no writing is done, and the practice of a good many operators of continually reading over what they have written to see that it is correct. The time required to correct mistakes has been figured as high as 15 per cent. Another reason for the tremendous fall in speed is probably the strain on the eyes, which are constantly dancing over the characters marked on the keys. This strain should not be underestimated, as the eyes of many operators have been affected by it, and it is further evidenced by the experts, who prefer blank keys, so as to avoid the blurring caused in rapid writing.

It is interesting to note the number of strokes each minute that the hands are capable of, if depressed alternately. More than 700 strokes can be made in a minute, and more than 400 can be performed without undue exertion or effort. Now, taking five strokes to a word (which is about the average), that would mean 80 words a minute comfortably, and after making due allowance for the time occupied in entering the paper and returning the paper carriage after each line, it would still be about double what is done ordinarily on a typewriter. The fault for the loss of speed appears to lie in either the method of operation or the keyboard. If a keyboard could be constructed that could be readily memorized, the eyes would be relieved and the speed increased, especially in copying, when the eyes could be kept on the copy and would not have to keep shifting the eyes from the keys to the copy. Such a keyboard would necessarily have to be compact, and with a very limited number of keys, but for that very reason there would be a gain in limiting the motion of the hands required to select the required key. If, furthermore, such a keyboard could allow an alternate action of the hands without deviation, the speed would be increased without extra exertion. Then concerning the mistakes that occur from depressing the wrong key, and which are realized the instant they are made, but too late to avoid the wrong impression, they could be partially avoided if the printing did not occur till the next depression. That would mean that the machine would always be one letter behind.

It may be that the typewriting machine has reached its highest perfection, but in view of these facts it seems strange that there has been no radical improvement for fifteen years.—N. Y. Sun.

Wood Pulp.

More than 50 per cent of the saw mill owners to-day could make more money to sell their logs to be manufactured into wood pulp and paper than they can possibly expect to secure through sales of the same in the form of manufactured lumber. The wood pulp industry has far outstripped the manufactured lumber industry.

One factor in the pulp and paper business is not always recognized by the owners of spruce forests. When a pulp mill grinds up a million feet of logs into paper product, and the same is sold to the great newspaper corporations and printed upon day after day, that paper practically goes out of existence. Few think of saving a newspaper. The individual newspaper reader throws his paper after reading into the waste basket or kindles a fire with it, or it becomes the property of the old junk dealer, and practically passes out of existence. On the other hand, the piece of lumber which is manufactured goes into a substantial building, which lasts for generations. So that the great consumption of spruce for pulp and paper really amounts to so much raw material taken out of the market forever, and practically wasted so far as any subsequent use to which it may be applied is concerned.—Manuf. Gazette.

Lights and Colors.

It has often been observed that a bright scarlet uniform will, in a good photographic dark room with ruby-glass windows, appear perfectly white. On this subject Herr H. W. Vogel made some interesting communications to the Physical Society of Berlin at a recent meeting. Experimenting with oil lamps provided with pure red, green, and blue color screens, he found that when white light was rigidly excluded, all sense of color disappeared to the observers, and nothing but shades of black and white could be distinguished on objects in the room. He further found that a scale of colors illuminated by red light showed the red pigments as white or gray, which abruptly turned into yellow, and not red, on adding blue light. Hence a color was perceived which was not contained in either of the sources. Red and yellow patches appeared of the same color, so that they could hardly be distinguished. But the difference was at once brought out by adding green instead of blue light. How very much the kind of sensation experienced depends upon the intensity of illumination is easily seen in the case of the region of the spectrum near the G line of Fraunhofer. This region appears violet when its luminosity is feeble, blue when it is stronger, and may even appear bluish-white with strong sunlight, so that the assertion often made that with normal eyes a definite color sensation corresponds to a definite wave length, cannot be upheld. Herr Vogel comes to the conclusion that our opinion as to the color of a pigment is guided by our preception of the absence of certain constituents. Thus a red substance is only recognized as such when light of other colors is admitted, and we perceive its inability to reflect these.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STOPPING AND STEERING BOATS.—Henry A. Sheldon, Arcadia, R. I. Wings which may be laterally projected from the boat at opposite points not far back from the bow are provided by this inventor, in connection with a novel operating mechanism, in which steam power is applied through curved cylinders, actuating a curved piston rod, to move either one or both the wings to an outward positon, at right angles to the hull, or to an inner position in line with the side of the hull. The motor mechanism is controllable from the pilot house, and affords means for conveniently adjusting the wings as may be desired.

Railway Appliances.

CAR FENDER.—William A. Morris, Brooklyn, N. Y. Under each platform is a frame with outwardly and downwardly extendingcurved guideways, to receive the side bars of a fender covered with a suitable netting, and having at its front end wheels or shoes adapted to travel on the track rail. The side bars have each a rail to prevent a person picked up from falling off the fender. Centrally on the inner end of the fender is an eye adapted to connect with a bolt sliding on the under side of the platform, the motorman or gripman, by simply pressing with his foot upon a stud, disengaging the bolt from the eye and permitting the fender to slide downward and forward, in position to readily pick up a human being. When the fender is not desired for use, it is moved upward on its guideways and held in withdrawn position under the platform by the engagement of the eye with the bolt.

SWITCH LOCK.—John W. Tew, Rome, Ga., and John D. Riggs, Selma, Ala. This is an automatic safety lock to prevent the interference of unauthorized persons with a switch. It is an improvement on a formerly patented invention of the same inventors, and comprises a lock projection or bolt normally in position at the side of one of the movable switch sections, to lock such section and its mate from movement, tripping plates being so connected with the operating devices that the weight of a passing locomotive withdraws the bolt and permits the switch to be thrown by hand or in any other manner. The construction is simple, having no parts likely to get out of order, and this invention relates particularly to improvements in the devices for operating the bolt.

NUT LOCK.—David C. Wetsel, Carrollton, Pa. This is a device especially adapted for locking nuts on fish plate bolts of railroad tracks. The nut has a shoulder adapted to fit against a shouldered locking block with a radial wing at each side, a fish plate recessed on one side near the bolt receiving one of the wings. The improvement affords convenient means for quickly locking the nut on a bolt, permitting the nut also to be partly or entirely removed from the bolt.

CAR BELL RINGER.—Samuel A. White and Augustus M. Glover, Savannah, Ga. This is an improvement in bell-ringer attachments operated from the axle of a car. A hinged bar is arranged near projections revolving with the axle and connected with two springs of different tension acting in opposite directions, the springs being also connected with a rod beneath the car to which tension may be applied to overcome the stronger spring, allowing the weaker one to throw the bar into contact with the projections on the axle, thus working an alarm. The attachment includes a suitable operative connection with a foot piece on the car platform, by pressing upon which the alarm will be sounded, but will cease as soon as the foot pressure is removed.

MAIL BAG HANGER.—George M. Patterson, Gertrude, Ga. This improvement comprises a standard with an upper and a lower arm, the arms being provided with bag-retaining devices, each having a number of hooks or cleats to which a mail bag may be attached, the devices being adapted for complete rotation and to be automatically placed in position for use by the movement imparted when the bag is removed. When the bag is caught by the gathering arm of the mail car it may be readily drawn from its support.

Electrical.

SIGNAL SYSTEM.—Webster Gillette, New York City, and Alexander S. Williams, Long Island City, N. Y. This improvement comprises a closed conductor connecting two stations, a battery arranged for cutting into the closed conductor for signaling, and a telephone support with switch contacts for completing the local and line circuits. The system may be used in connection with the existing wiring of hotels, factories, small telephone exchanges, or with smaller wiring arranged specially for use under this improved system. While the conductors are all closed, the circuits of the batteries are open, and the conductors are always in condition for sending and receiving signals and for use for telephonic communication.

SHIP'S LOG AND COURSE INDICATOR.—John P. Rogers, Moncton, Canada. This invention includes a log to be towed as usual, and printing and registering mechanism carried on the vessel to automatically record the distances, so printing the mileage figures that the deviation of the ship from a prescribed course will be indicated. Electrically operated means are provided for controlling the printing and registering mechanism, and affording a reliable circuit breaker in the log proper to make and break the circuits and set the controlling mechanism in operation. A wind-indicating device is connected with the apparatus to indicate leeway in the same manner as the current indicator, the effect of the wind on the log line being counteracted by the disk of the wind indicator and its electrical connections.

Mechanical.

FORGE.—Aaron Rice, Northport, Ala. The hearth of this forge has a water compartment under its basin, connected by pipes with the lower end of a boiler, the pipes being preferably one above another to establish a circulation. The boiler drives an engine which operates a blower with a blast pipe projecting over the basin of the hearth, a water jacket on the front of the boiler surrounding the blast pipe.

MACHINE FOR CURLING HAT BRIMS.—Joseph Ives, Newburg, N. Y. The machine has a wheel with concave flange, a small wheel or button with convex face being adapted to press the hat brim against the flanged wheel, while a shoe made concave in the direction of its length has a concave groove in the edge. A gage is provided for guiding the hat, springs for pressing the button against the brim, a cam for withdrawing the button, and means for heating the shoe, flanged wheel and button. As the hat is passed between the revolving flanged wheel and button, under the application of heat, the brim is given the proper curvature, being received and prepared for curling by the shoe, and also preserved in such curl as it leaves the wheel and button.

Agricultural.

CUTTER FOR HARVESTERS, ETC.—Frederick Friesz, Shenandoah, Iowa. According to this invention the cutters of reapers, harvesters, and similar machines are made in stellated form, to rotate individually upon their own axis, and collectively around a guide of predetermined construction, the cutters presenting themselves successively in position for cutting. They are designed to be operated by means of an endless chain belt with the least possible friction, the cutters clearing themselves from the grass or grain cut, preventing clogging.

HEDGE AND LAWN EDGER.—Myles Y. Warren, Philadelphia, Pa. This is a simple, inexpensive and light machine for trimming lawns and hedges by being pushed along the borders. Its wheel-supported frame has one straight side with blades at its front edge, the opposite side near the front being inclined toward the straight side, and the bottom of the frame extending outward beyond the inclined side and having at its front a scraper. On the shaft, on the inner face of the straight side of the frame, are radial arms which press the twigs, grass, etc., against the blades, in advance of which, near the ground, is a small circular cutter.

Miscellaneous.

RECOIL OPERATED AUTOMATIC ORDNANCE.—Alfred A. McKnight, Wilmington, Ohio. According to this invention a frame in which the barrel is supported and movable has separated abutments, a lever pivoted to and movable with the barrel having an arm connected with and operating the breech block, while a second arm extends between and is operated by the separated abutments. The hammer is pivoted to and the trigger supported on the framing, the reciprocating barrel having portions by which to cock the hammer and pull the trigger. The several moving parts are designed to be operated, after the first firing, by the force of the recoil, or by springs acting in opposition thereto, the gun barrel being moved rearwardly, the hammer cocked, the breech block lowered, the cartridge thrown out and a new one inserted, the barrel moved forward, the breech block readjusted, and the hammer cocked and the gun fired.

SWORD SCABBARD.—Henry O. Weller, Butte, Montana. This scabbard has an opening in one of its walls at the mouth, and the sword hilt has a lug shaped to enter and fill the opening. The construction of the scabbard is such that the sword may be guided therein more quickly and conveniently than in the ordinary scabbard, a beveled recess in its upper end serving as a guide to direct the sword to the mouth of the scabbard.

VOTING MACHINE.—Frank H. Gilbert, Ridgefield, Washington. This machine provides a sheet or tape to be passed between punch bars with apertures corresponding to the candidates to be voted for, means for puncturing the sheet or tape, and a concealing slide, whereby neither the following voter nor the inspector may discover who was voted for. Its construction is designed to facilitate voting without mistake by an ignorant person, and when each vote is cast an alarm is sounded, when the official in charge may place the recording material in position to receive the next vote, means being also provided for making a duplicate record, one of the records to be removed from the machine without allowing access to the other record.

CARBON HOLDER FOR BLANK BOOKS.—Lewis A. Lipman, New York City. The book, according to this invention, has at its back a thickened leaf of greater length than the other leaves, the leaf being folded in at the edge of the book, and thus constituting a holder of great simplicity and cheapness for the carbon sheets, which may be readily removed as desired.

INK WELL.—Joseph Morton, New York City. As an improved article of manufacture, this inventor has devised an ink well designed to prevent the ink from marring the beauty of the crystal effect of the well body. The body is of glass or crystal, and removably fitted in its central recess is an exteriorly polished cup-shaped ink well, of metal, adapted to reflect the light and add greatly to the appearance of the entire ink well, the ink being invisible through the sides of the well body.

SASH BALANCE.—Joseph H. Bane, Barre, Mass. According to this improvement a pinion loosely mounted on a spindle is adapted to engage a rack on a sash, there being a pawl and ratchet connection between the pinion and spindle, and a brake engaging the spindle. The improvement may be applied to an old as well as a new window, and its action is not interfered with by warping of the window frame or sash, the window being raised and lowered as conveniently as if the old balance were employed. The locking device is at one side of the sash and roller bearings at the opposite side.

LOCK AND STAY FOR WIRE FENCES.—Cyrus M. Suter, Ashton, Ill. This improvement consists of a locking plate with longitudinal slots extending from the ends inwardly to within a short distance of the center of the plate, and forming two jaws at each end of the plate, which is to be used in connection with a link of wire adapted to extend across a runner, the wire having a loop at each end and being bent near its center. A simple and inexpensive method is thus afforded of securing the runners of wire fences from vertical movement.

CART.—Amasa L. Smith, Carnes, Iowa. The axle of this cart has an integral yoke-like body, and the running gear is so constructed that it is adapted to receive a dumping body or a barrel-like receptacle, which may be quickly taken up from the ground by the manipulation of the running gear without being touched by the operator, and may also be gently dropped upon the ground. It is especially adapted for use as a slop cart.

HORSE WEIGHT.—David B. Maconachie, Toronto, Canada. This is a hollow weight block with ball-like handle, and in the block is a spring-controlled strap roller to which is attached a self-wrapping halter that may be extended from the weight as desired, automatically returning within the weight when the animal is detached from the halter and the weight is placed in the vehicle.

GARMENT HANGER.—Edgar W. Horner, Connellsville, Pa. This is a device to support trousers with the waistband hanging downward, to remove bagginess at the knee. The trousers may be clamped in the hanger without marking them at the point of contact, and the device is also adapted to serve as a support for a coat and vest, or other garments.

CLOTHES HANGER.—John H. J. Ronner, New York City. This device consists of separable jaws with opposite clamping faces and a suspending hook extended between them, forming a simple and inexpensive means of holding an entire suit of men's clothes, while also adapted to support other garments. The clothes are so held as to prevent their becoming creased or losing their shape.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

APRIL, 1895.—(No. 114.)

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6471) G. E. M. says: Please give a receipt for a paste for pasting the labels on tin cans. A. Make a paste by dissolving rye flour in a solution of caustic soda, dilute with water, stirring all the time. Add to this paste Venetian turpentine—a few drops for each ½ pound flour. Adheres firmly to all metals, tin foil, glass, etc.

(6472) P. J. R. says: Kindly tell me how mushrooms are canned? A. Choose freshly gathered mushrooms, white, full, and firm; cut away the gritty part near the stalk, and throw the mushrooms into a basin of cold water; wash them quickly and drain them on a cloth. Put in a stew pan the juice of a lemon, an equal quantity of water, and a pinch of salt. The above quantities are calculated for 2 pounds of mushrooms. Turn each mushroom, put them into the stew pan containing the lemon juice, and toss them to impregnate them with the liquid. Cover the stew pan, put it over a brisk fire, and boil the mushrooms for four minutes, tossing them occasionally; and pour the whole into a basin. When cold, put the mushrooms in quart tins, cover them entirely with the liquor in which they have been boiled, filling up the tins with cold water, previously boiled if the liquor is insufficient. Solder on the covers and boil the tins in water for two hours.

(6473) E. H. says: Can you give me the ingredients and proper mixture of Angostura bitters? A. Four ounces gentian root; 10 ounces each calisaya bark, Canada snake root, Virginia snake root, licorice root, yellow bark, allspice, dandelion root, and Angostura bark; 6 ounces cardamom seeds; 4 ounces each balsam of tolu, orangetis, Turkey rhubarb, and galanga; 1 pound orange peel; 1 pound alkanet root; 1½ ounce caraway seed; 1½ ounce cinnamon; ½ ounce cloves; 2 ounces each nutmegs, coriander seed, catechu and wormwood; 1 ounce mace; 1¼ pound red sanders wood and 8 ounces turmeric. Pound these ingredients and steep them for fifteen days in 50 gallons proof spirit; before filtering, add 30 pounds honey.

(6474) M. D. H. asks: 1. Can a No. 10 steel wire can be used to run around an iron pulley, and what size pulley and groove? A. Yes; pulley should be 3 feet diameter with V groove rounded at bottom to fit the wire. 2. And also size of pulley that a ⅜ inch wire hoisting rope will wind around and be serviceable? A. A 20 inch to 2 foot drum or pulley for the wire rope, according to the flexibility of the rope.

(6475) L. E. D. writes: 1. I have a storage cell of 8 volts and 40 ampere hours which I charge with 6 gravity Crowfoot cells (6×8) connected in series. They do not charge it more than one-third. When connected in multiple series, they do not charge it at all. Can you tell me where the trouble is? A. You need for proper charging at least nine Crowfoot batteries in series, to obtain sufficient voltage. 2. Please give formula for calculating voltage and amperage of several cells of primary battery when the voltage and amperage of one cell is known. A. These calculations are made by Ohm's law. The amperage depends on the resistance of the entire circuit, the voltage on the number of cells in series.

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See Sloane's "Arithmetic of Electricity," $1 by mail. 3. Please tell me if it is proper to say amperage or ampage. I have heard the word pronounced both ways. A. Amperage.

(6476) J. F. B. writes: Will you give me the approximate diameter of a windmill that will develop about one horse power with a twenty mile per hour breeze? Also what would be the increase in power with additional wind pressure, say of five and ten per cent? A. An 18 foot mill should be equal to 1 horse power. The increase of power will be as the square of the ratio of the velocity of the wind. Thus 10 per cent to 20 m. is 22 miles, and $\frac{22}{20}=1{\cdot}1$, the square of which is 1·21, so that the 1 horse power mill will yield 1·21 horse power with a 22 mile wind.

(6477) A. C. M. asks if two of the simple electric motors described in "Experimental Science" can be put on one shaft, and what horse power they would develop together at full capacity, also how many volts and amperes would the two motors require at full load, and whether each motor should be connected separately. A. You can connect as described, and get nearly two-tenths horse power at eight volts and eight or nine amperes.

(6478) W. B. asks: What is the best way to produce the greatest amount of heat by electricity? If possible, give several ways of producing heat by electricity, and state which is the best to create the greatest amount of heat. A. All methods of producing heat by electricity are based on the arc or on plain incandescence of a conductor. For examples of the first we refer you to our SUPPLEMENT, Nos. 904, 905, 901, 986, 610, 840, 635; for the latter method, used on the large scale in electric welding, we refer you to our SUPPLEMENT, Nos. 582, 682, 768, 892.

(6479) D. J. F., Newfoundland, writes: 1. What is a ship's metacenter, and how is the same found? A. The metacenter of a vessel is the point of intersection of the vertical line passing through the center of gravity of the vessel, when in its position of equilibrium, and a vertical line through the center of gravity of the water displaced when the body is careened or heeled over through any given angle, as of a vessel rolling in a sea. It is found by computing the center of gravity of the vessel as it floats when at rest, and the center of gravity of the mass of water displaced at any angle at which the vessel may be careened. The point of meeting of a vertical line from this last point at the angle of careening and the central line of the vessel is the metacenter. The height of this point above the center of gravity of the vessel is the measure of its stability. See Haswell's "Engineer's Pocket Book" for examples, $4 by mail. 2. How is the contour of the keel of a ship found, when the same is not straight, as is very often the case in wooden vessels? Is it found from the keelson? If so, how? And provided the ship be laden, how is it found? A. Irregularities in keel alignment can be approximated by examination of the lines of the keelson. When irregularities are suspected, the keel blocks are made adjustable to bring them to a bearing. With a loaded vessel the problem becomes complex and may require the service of a diver. 3. How is the dead rise, which governs the height of the bilge blocks which support a ship in dry dock, found? A. The bilge blocks should be adjustable in height and angle and also be movable to their proper bearing when the keel touches the keel blocks. The dead rise must also be found by examination inside or outside. 4. Is any treatise or book published giving directions for dry-docking ships? If so, please give the name, price, and where procurable? A. There is no work on dry-docking of ships. We have one copy of Stuart's "Naval Dry Docks of the United States," now out of print, price $6.00.

(6480) G. D. asks: Could you tell me why a permanent magnet was used in a telephone? I thought it was to give tension to the diaphragm. A. It is far more sensitive than an unpolarized core.

(6481) C. W. C. asks: 1. Is the large plunge battery, Fig. 394, in "Experimental Science," sufficient to run a one horse power motor? A. No. 2. Is the dynamo described in SUPPLEMENT, No. 600, with proportions and directions given, suitable for a motor? And if so, could it be driven with above battery, and what power would it have? A. It makes a good motor and can be run with about three times this battery, and would give about ¼ horse power for a short time only. The power would soon diminish. 3. How long would the battery run at full power on one charge? A. It would depend on the current taken from it. It would decrease rapidly after the first half hour.

(6482) H. K. M. asks: 1. How many horse power will it take to equal 1 kilowatt, or what is the relation between 1 horse power and 1 kilowatt? A. 1 horse power is equal to 0·7459 kilowatts. 2. You give a receipt for cleaning clothes, in SCIENTIFIC AMERICAN, of March 16, page 166. Does it make any difference how this should be mixed? If so, which should be mixed first? A. It makes little or no difference how the ingredients are mixed. 3. In your columns you advertise the "Kombi." Is it a success? How long will one last, and what will be expense of having negatives finished? A. Address the advertisers. They will give you all the information desired.

(6483) C. A. C. asks: 1. Which will work on the longest line (the line being metallic circuit) a Blake or a Hunning transmitter? A. We cannot undertake to pronounce upon the relative merits of the two transmitters. Both are good. The Hunning's transmitter is described in the SCIENTIFIC AMERICAN, vol. 64, No. 4. 2. What is the internal resistance of ordinary gravity batteries? A. Two to four ohms. 3. Some of the SCIENTIFIC AMERICANS tell how to make storage batteries. A. See SCIENTIFIC AMERICAN, vol. 62, No. 10; vol. 65, No. 22; vol. 68, No. 9; vol. 69, No. 20; and our SUPPLEMENT, Nos. 838, 845, and 997. 4. What is a two phase alternating dynamo? A. A dynamo of the simple alternating current type produces a single phase current. By special connections it may be made to give polyphase currents. In Walmsley's "Electric Current," $3 by mail, page 458 et seq. the production of polyphase currents is very well explained. A two phase dynamo gives a two phase current.

(6484) A. L. asks: 1. How is it that a 15 candle power incandescent lamp, as well as a 16 candle power lamp, can be bought, the first one needing only about 15 volts to make it give the proper light, and the second one will require some 50, 75, or 125 volts to make it give the proper light? See E. S. Greeley's Catalogue, N. Y. A. The low voltage lamps are of proportionally lower resistance; hence they pass more current, so that the watts per candle power are the same in all. The watts is the unit of rate of work—the volt is merely the unit of electric pressure. 2. How is the aluminum iodine battery made, what are the elements and charging fluid, and what is its lasting power and quality, both with regard to material as well as electricity? A. Carbon and zinc are the electrodes; the excitant is a paste of aluminum chloride, zinc oxide, manganese dioxide and water; the depolarizer is iodine sulphide or a mixture of iodine and mercuric oxide. The battery proved unsatisfactory on the time test. The voltage was 1·4 to 1 65. An illustrated paper on the subject appeared in the Journal of the Franklin Institute for March and April, 1893.

(6485) E. A. Le S. asks: Where can I find the results of a complete analysis of common sea water? A. The following is of sea water from the British Channel:

Water	963·745
Sodium chloride	28·059
Potassium chloride	0·766
Magnesium chloride	3·666
Magnesium bromide	0·029
Magnesium sulphate	2·296
Calcium sulphate	1·406
Calcium carbonate	0·033

—Schweitzer.

(6486) P. C. S. asks: How can a Leyden jar be disruptively discharged so you can get a current vibrating with extreme rapidity? If a two quart jar were charged by a battery and then discharged as above, would the current be dangerous, or will it run one of Tesla's coils? A. The ordinary discharge of a Leyden jar is of the character you describe, but as the entire duration of the discharge is very short, it cannot be used for a Tesla coil.

(6487) J. M. B. says: Will you have the kindness to give a receipt for making camphor ice? Also do you publish a book on manufacturing perfumery and cosmetics? A. 1. Oil of sweet almonds, 2 ounces; spermaceti, 4 ounces; white wax, 2 ounces; camphor ½ ounce; melt them over a water bath, run in moulds of proper size and form. 2. Expressed oil of almonds and rose water, each 1 pound. White wax and spermaceti, each, 1 ounce. Camphor, 2 ounces. Oil of rosemary, 1 drachm. Melt together. Glycerine may be substituted in part for the oil and rose water. From our "Cyclopedia of Receipts, Notes and Queries," price $5, which contains several hundred formulas for cosmetics, perfumery, toilet preparations, etc.

(6488) C. H. asks: How many B. T. U. (or heat units) are there in one gallon of alcohol as compared to one gallon of coal oil? A. For a pound of alcohol the thermal units are 12,929; for a pound of petroleum, 27,531. You may take refined coal oil as of about twice the heating power of alcohol.

(6489) A. C. asks: 1. Of what number of wire and what size must I make an induction coil to lift one-third of a pound, and how much battery will be required to operate six of them at once? A. The size depends on the current you propose using. A core of one-quarter inch area must be charged with about 9,000 lines of force per square inch of section to have the desired traction, requiring perhaps twenty or thirty ampere turns. The question of leakage so complicates solenoid and straight bar calculations as to affect considerably their reliability. The ampere turns can be given by low potential batteries with low resistance coils or vice versa. 2. How large and at what distance apart shall I make holes in a tube 9-16 inch in diameter to make notes of a diatonic scale, the same to be made like a small boy's cane whistle? A. Arrange them on the principle that the undulations of the note vary with the length of the pipe as determined by the position of the holes. For narrow (1:12) stopped pipes the formula is $L=(2p+1)\frac{l}{4}$—and for open pipes $L=\frac{p\,l}{2}$; in which L=length of pipe, l=length of wave to be produced, p=any whole number. By taking p=1 you will get the length for the fundamental, and the other valnes of p will give the harmonics; l is obtained by the formula $l=\frac{1120}{n}$ in which n= the number of vibrations per second, which you can take from any table of the diatonic scale. Thus l is expressed in feet or a fraction of a foot. When the ratio of diameter: length : : 1:12 ceases to exist or to be exceeded, an arbitrary formula must be used. Consult Ganot's "Physics."

Query No. 6406.—In your answer to R. K. B., February 23, 1895, No. 6406, I am inclined to think his trouble does not lie with dirty contacts, but with an improper adjustment. I have frequently met with the same trouble, and bell would ring when several pushes were given successively. The successive pushes I believe give an accumulative series of vibrations to the bell hammer, and if synchronized properly will finally set the bell ringing. In such cases I generally investigate the adjustment screw and find it a little too far from the contact on the spring of the vibrating armature. —Thos. D. Gillespie, Pittsburg.

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April 2, 1895,

AND EACH BEARING THAT DATE.

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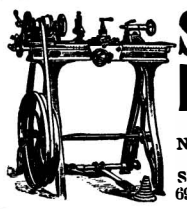

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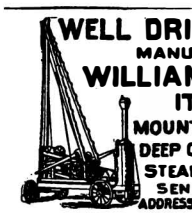

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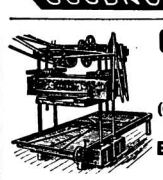

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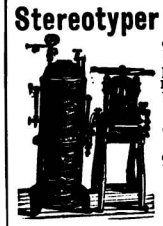

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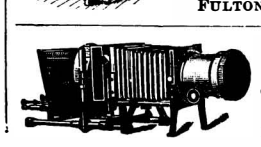

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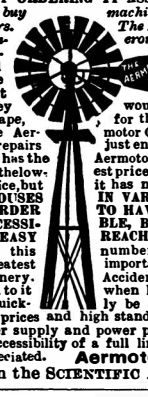

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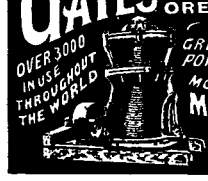

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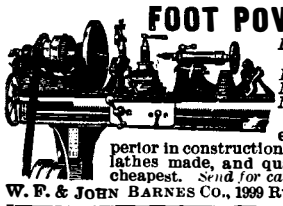

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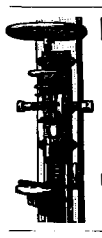

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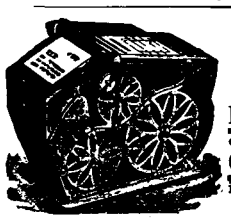

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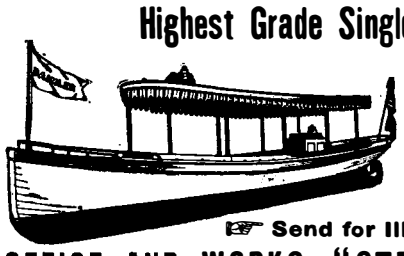

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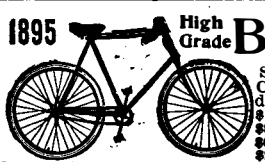

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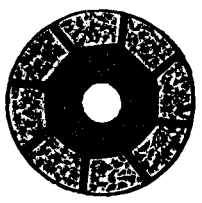

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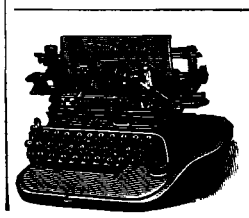

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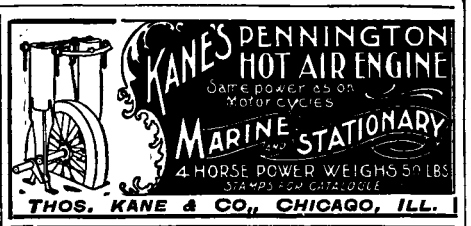
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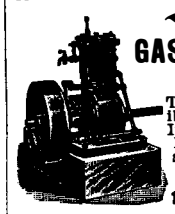

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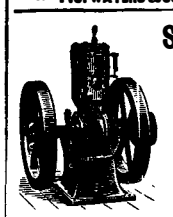

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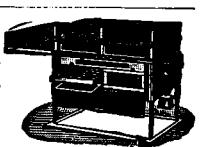

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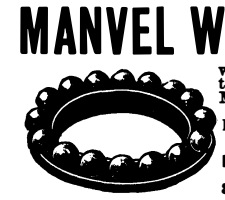

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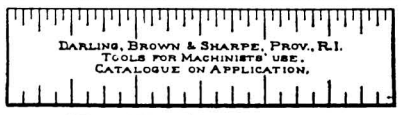

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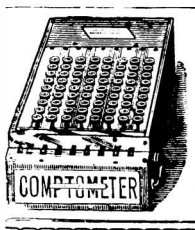

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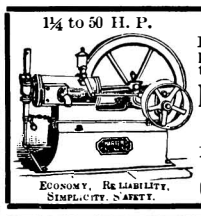

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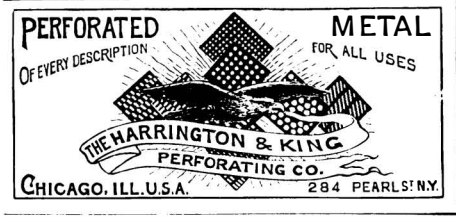

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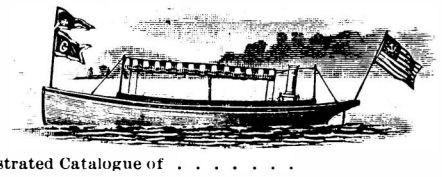

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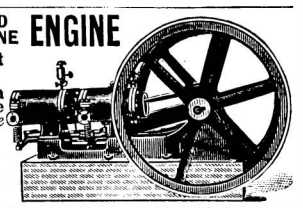

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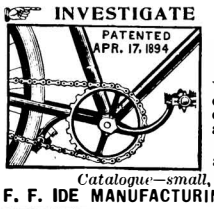

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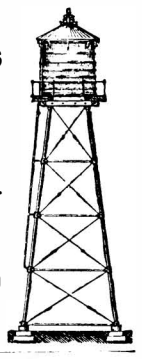

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